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THE CANADA OIL AND GAS LANDS ADMINISTRATION

ANNUAL REPORT

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COGLA Offices

This report is submitted to the
Parliament of Canada in accordance
with Section 73 of the
Canada Oil and Gas Act.

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THE CANADA OIL AND GAS
LANDS ADMINISTRATION

ANNUAL REPORT
1984



Photograph courtesy of Husky Oil Operations Ltd.



I am honoured to submit to Parliament the third annual report of the Canada Oil and Gas Lands Administration.

A basic premise shared by the Government of Canada and the oil and gas industry is that only a vital, thriving energy sector can serve as an engine for economic growth in Canada.

With this in mind, I have travelled across Canada to consult with all elements of this essential industry on how best to catalyze this 'engine'.

The prognosis is very positive, not only for the conventional resources in the provinces, but also for the offshore and onshore frontier areas in the Canada Lands. In the North and East Coast offshore, there is a growing optimism that development is no longer a dream for the future, but a fast approaching reality.

As this annual report indicates, a huge investment has been made in exploration activity on the Canada Lands and the best prospects are being evaluated. Exploration must continue, but we are also on the verge of important development projects.

A healthy environment for activity on the Canada Lands requires the full cooperation of the federal and provincial governments. During 1984, great strides were made in establishing an offshore management regime with Newfoundland. In June, Mr. Mulroney, then Leader of the Opposition, signed an agreement in principle with Premier Brian Peckford, making detailed commitments on what he would do if elected.

After the election in September, I initiated extensive discussions with my counterpart in Newfoundland and his officials. (These negotiations led to the February 11, 1985 signing of the Atlantic Accord, a Memorandum of Understanding between the Government of Canada and the Government of Newfoundland and Labrador on offshore oil and gas management and revenue sharing. This falls outside the period of this report.)

In Nova Scotia, I was pleased to join my provincial counterpart in signing the Canada-Nova Scotia Development Fund Agreement, which will provide \$200 million during the next four years to help in building the infrastructure necessary for offshore development. At the same time, I approved the first four projects under that agreement – which is an integral part of the Canada-Nova Scotia offshore legislation approved by Parliament and the Nova Scotia Legislature in 1984.

The Government is reviewing the recommendations of the Royal Commission on the Ocean Ranger Marine Disaster, Report One, which was released in 1984. COGLA in the year under review was responsible for safety regulations in the offshore and onshore Canada Lands and had already incorporated many of the Royal Commission's recommendations into guidelines and draft regulations.

In December, the Minister of National Defence and I announced further increases to search and rescue capability on the Grand Banks, notably through the addition of new fixed wing aircraft, and the forward deployment of helicopters. The National Defence Search and Rescue capability is complemented by industry, as agreed with COGLA as part of the guidelines for offshore drilling.

While exploration and development on the Canada Lands are priorities, they can only be pursued with full regard for the safety of workers and the protection of the environment.

The exploration and development of our resources on the Canada Lands will proceed safely and productively. In the continuing spirit of cooperation with the provinces and territories, and in close consultation with the industry, we are optimistic about the future.

Pat Carney

I am pleased to join with the Honourable Pat Carney, Minister of Energy, Mines and Resources, in the submission of the third annual report of the Canada Oil and Gas Lands Administration, which acts on my behalf north of 60°.

Although my priority in the initial period of the new government has been to consult as much as possible with the people who live and work in the North, I share the premise of my colleague that a strong, growing energy industry is one of the "engines for economic growth" in this country. No lasting social progress can be made without comparable advances in the economic sphere: this is the basis for the Government's encouragement of economic development in the North.

The year 1984 was one that marked consistent progress. This augers well for the future of the oil and gas industry in Canada's energy frontiers.

Construction activities related to the Norman Wells oil field expansion project continued within targets. Its scheduled completion in early 1985 will permit oil production to increase from about 475 to 4400 cubic metres per day (3000 to 27 700 barrels).

Significant oil and gas discoveries continue to be made in the Mackenzie River Delta-Beaufort Sea region, and there is promise of important discoveries in the Mackenzie Valley. Renewed interest by industry in the valley resulted in 15 new exploratory wells being drilled in 1984.

Although development continues to face technological challenges in the Arctic Islands, a milestone was reached when a development plan application was submitted for the Bent Horn project on Cameron Island. The project will result in the first crude oil in the High Arctic to be produced and shipped by tanker through the Northwest Passage to southern markets.

All of this activity means economic growth and jobs for people living in the North. Exploration expenditures in 1984 amounted to approximately \$1 billion in both territories. Some 3900 people were employed in exploration and development.

In 1984, the Beaufort Sea Environmental Assessment Review Panel submitted its official report and recommended phased, appropriately scaled development. The report is being carefully reviewed by government prior to responding to its recommendations, which will set the stage for future development activities.

Such activities hold out great promise over the next decade. Gulf's Amauligak oil discovery in the Beaufort Sea and Esso's Tuk gas condensate discovery in the Mackenzie Delta may herald commercial reserves. Known gas fields in the High Arctic and the Delta represent some of the largest fields yet discovered in Canada. Industry interest in the development of new northern hydrocarbon reserves has been further heightened by proposals to construct oil and gas pipelines up the Mackenzie Valley and various marine transportation proposals for liquefied natural gas from the Arctic Islands.

Future oil and gas activities will involve northerners to an increasing degree. An important event in this respect was the signing of the Inuvialuit Final Agreement, which was enacted into law in July 1984. The legislation provides local residents in six communities in the Mackenzie Delta and western Beaufort Sea, an area of promising oil and gas potential, with a range of socio-economic benefits and rights. The agreement will also lead to the development of a new, direct relationship between industry and the Inuvialuit on proposals to use their land, through their land administration structures.

Like most things in the North, development of the oil and gas industry is confronted by many challenges. I believe, however, that the rewards are great for northerners and for the Canadian people as a whole. It is my objective to ensure that future development will realize its promised rewards, in a responsible environmental and socially beneficial manner.



A handwritten signature in cursive script, appearing to read "David Crombie".

David Crombie





Moratorium area



Administrative Line of Convenience between the Department of Energy, Mines and Resources (below line) and Indian Affairs and Northern Development (above line)



Highlights of 1984

The primary responsibility of the Canada Oil and Gas Lands Administration is to encourage the oil and gas industry to discover, develop and, ultimately, to produce oil and gas on the Canada Lands. COGLA must ensure that activity takes place in a manner that is safe and environmentally acceptable, and provides for full and fair access to Canadians to the industrial, employment and other socio-economic benefits.

During 1984, exploration activity resulted in 11 discoveries, more than double the number in 1983. In addition, 47 new exploration agreements were concluded, bringing the total to 167 agreements negotiated under the requirements of the Canada Oil and Gas Act.

A Call for Proposals under the Canada Oil and Gas Act was announced in late December when, following a decision of the Canada-Nova Scotia Oil and Gas Board, the Government posted two parcels of lands offshore Nova Scotia south of Sable Island.

Progress was also made toward eventual development of two major projects. The Hibernia oil field on the Grand Banks and the Venture and other natural gas discoveries near Sable Island saw further delineation drilling. In addition, engineering and other development studies were conducted by Mobil Oil Canada, Ltd. and its partners.

A submission by Panarctic Oils Ltd. for development plan approval and a production licence for its Bent Horn oil field in the High Arctic was reviewed. The Bent Horn project would mark the first time oil has ever been produced commercially from the Arctic Islands.

The construction stage of the \$600 million expansion of the Norman Wells oil field moved towards final completion in 1984. The expansion project, which includes a waterflood project, will increase production capacity from 477 cubic metres (3000 barrels) a day to 4400 cubic metres (27 700 barrels) a day.

The thrust continued towards encouraging participation by Canadian-owned companies in the frontier oil and gas industry. Husky-Bow Valley, Home, Petro-Canada, Canterra, Dome and Panarctic played increasingly significant roles on the Canada Lands. In the Mackenzie Valley, much of the exploration during the year was conducted by smaller Canadian operators.

In its continuing effort to encourage a 'full and fair' opportunity for Canadian firms to benefit from the Canada Lands oil and gas activity, COGLA participated in the development of the Canadian Market Opportunities Program (CMOP), which brings together oil companies and Canadian suppliers.

Safety remained an important priority in 1984. COGLA cooperated fully with the Royal Commission investigating the 1982 sinking of the *Ocean Ranger*. Part One of the commission's report was released in the summer of 1984 and Part Two is expected in 1985. Many recommendations of the commission's report had already been incorporated into guidelines when Part One was issued.

COGLA also continued to consult and work with industry to ensure the highest possible standards of safety. For example, one COGLA-industry project which greatly enhances the safety of divers working in the offshore was the development of a new diving bell. Comprehensive diving regulations were also developed in consultation with the industry. During the year COGLA conducted more than 200 inspections of drilling rigs and production sites and the Canadian Coast Guard conducted marine inspections of all drilling rigs and standby vessels.

The well control problems at Uniacke G-72 off Nova Scotia represented Canada's first experience with an incident of this nature in the marine environment. Its successful resolution demonstrated that industry and government have an effective response capability to address offshore emergency situations.

Oil and gas resources cannot be developed without considering the possible effects upon the environment. In 1984, a report from the Beaufort Environmental Assessment Review Panel was received and a West Coast Environmental Review Panel was established. COGLA, in cooperation with the Newfoundland government and other federal government agencies, worked closely with Mobil on the preparation of a proposed environmental impact statement for Hibernia.

Legislation enacting the 1982 Canada-Nova Scotia Agreement was promulgated in 1984, giving legal status to the Canada-Nova Scotia Offshore Oil and Gas Board. The first projects under the \$200 million development fund were announced in November. The objective of the fund is to help Nova Scotia build the necessary infrastructure to support offshore development.

No significant oil spills occurred in 1984.

The Canada Oil and Gas Lands Administration

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a Memorandum of Understanding between the Ministers of Energy, Mines and Resources and Indian Affairs and Northern Development to support the achievement of mutually compatible energy and northern policy goals.

COGLA is responsible for the management of federal oil and gas interests on the Canada Lands, more than 10 million square kilometres which encompass onshore areas in the Territories and the Arctic, and offshore areas in Hudson Bay, and seaward from the Atlantic and Pacific coasts. COGLA is also responsible for the management of federal non-fuel mineral interests in the Atlantic, Pacific and Hudson Bay offshore areas and oil and gas and other minerals on federal Public Lands in the provinces.

The Administration serves as the principal point of contact between the federal government and the petroleum industry in all oil and gas activities on the Canada Lands. COGLA reports through the respective deputy minister to the Minister of Energy, Mines and Resources (for areas seaward of provincial boundaries) and the Minister of Indian Affairs and Northern Development (for the Territories and the Arctic offshore). Internal policy guidance is provided by the Policy Review Committee, which consists of the Administrator of COGLA and senior personnel from each parent

department; the committee ensures that COGLA's policy directions are consistent with the policy requirements of each department.

The organization comprises six branches at headquarters and three regional offices:

- The Land Management Branch is responsible for the administration of exploration and production rights under the Canada Oil and Gas Act. The branch negotiates exploration agreements, monitors interest owner performance and collects royalties and other revenues. It is also responsible for the issuance and administration of oil and gas rights in federal Public Lands within the provinces.
- The Engineering Branch is responsible for the regulation and monitoring of exploration, development and production under the Oil and Gas Production and Conservation Act. Authorization to undertake drilling activity is issued subject to environmental clearance procedures and safety inspections of equipment used by the industry.
- The Resource Evaluation Branch assesses the resource potential of the Canada Lands, authorizes geophysical and geological programs, analyzes geological factors and hazards in drilling programs, and monitors data and results from all oil and gas activity on the Canada Lands.
- The Environmental Protection Branch coordinates advice regarding the terms and conditions necessary for environmental protection and certain aspects of safety. In doing this, it assesses the effect of oceanographic, meteorological and ice conditions on human safety and protection; identifies the impact of drilling operations on marine and coastal biota, shorelines and fisheries; and evaluates the validity and effectiveness of contingency plans and compensation schemes.
- The Canada Benefits Branch evaluates and monitors companies' plans to ensure that Canadian workers and businesses are given full and fair access to the opportunities provided by oil and gas activity. Benefits packages are negotiated with oil and gas companies as part of exploration agreements and development plans.
- The Policy Analysis and Coordination Branch is responsible for the analysis and implementation of Canada Lands policy, and for liaison with other federal and provincial agencies.

Responsibilities include the issuing of Authorities to Drill a Well, authorization to undertake geophysical and geological programs, and conducting rig inspections and monitoring engineering, geological, environmental and Canada Benefits aspects of all industry operations. The regional offices also advise on policies, procedures and regulations from a regional perspective and undertake an important liaison role with provincial and federal departments.

COGLA also has a field office in Inuvik and an information office in Calgary.

Regulatory Process

The regulatory process normally begins under the Canada Oil and Gas Act with public invitations to bid for oil and gas rights on blocks of land through Calls for Proposals. Companies submit proposals for exploration agreements for the right to explore for oil and gas. The Minister, through COGLA, then negotiates exploration agreements with the successful bidding companies based upon their proposals. Operators are also required to submit a Canada Benefits Plan satisfactory to the Minister.

An operator's work program is assessed in terms of its environmental and operational acceptability. Before drilling activity can commence, an operator must receive Drilling Program Approval and Authority to Drill a Well, both granted under the Canada Oil and Gas Drilling Regulations. COGLA inspects and monitors all exploration activities.

Regional Offices

COGLA maintains regional offices in Yellowknife, Halifax and St. John's, which have operational responsibility for the North, the Nova Scotia offshore and offshore Newfoundland and Labrador, respectively.

An operator making a commercial discovery may apply for a production licence, provided Canadian ownership of the licence is 50 per cent or more. Ministerial approval of a development plan is required before production begins. The operator supplies relevant technical and environmental information in the development plan, and a proposal on benefits to Canada.



Supply vessels loading at St. John's dockside.

Photograph courtesy of Husky Oil Operations Ltd.

Exploration Activity and Results

During 1984, forty-three exploratory and ten delineation wells were completed, compared with twenty-nine exploratory and four delineation wells in 1983. Eleven wells flowed oil or gas when tested, an increase of six over 1983. There were two oil discoveries, three oil and gas discoveries and six gas or gas-condensate discoveries. Follow-up drilling will be required to determine the commercial potential of these finds. Development drilling continued in the Norman Wells field with 69 wells completed during the year.

Atlantic Offshore

Drilling activity off the East Coast increased during the year, with 23 wells drilled to total depth, three more than in 1983. Fourteen drilling units were active for most of the year. Sixteen exploratory wells were drilled and resulted in three gas and condensate discoveries in the Sable Island area offshore Nova Scotia, and one oil, one gas condensate and two oil and gas discoveries on the northeast Grand Banks. Delineation wells were drilled on the Venture structure (one well), to the 1983 Glenelg J-48 gas discovery (two wells), at Hibernia (two wells) and a follow-up to the May 1984 oil discovery at Terra Nova (one well). A relief (service) well was started on the West Venture structure but was abandoned at a shallow depth.

On the Scotian Shelf, Shell and partners reported gas and condensate discoveries in two of their wells. Uniacke G-72, spudded in mid-1983 north of Sable Island, flowed gas early in 1984 from one of the five zones tested at rates up to 583 thousand cubic metres per day, with condensate at 23.5 cubic metres per day. In mid-year, Shell's Alma F-67 well southwest of Sable Island flowed gas from three of five zones tested at up to 842 thousand cubic metres per day, with condensate at 59 cubic metres per day. Shell announced that plans for delineation drilling were under study.

Husky-Bow Valley revealed that gas was tested in their Chebucto K-90 well south of Sable Island. However, full test results have not been released.

Six other exploratory wells on the Scotian Shelf failed to find hydrocarbons or had non-commercial shows of gas only. A fourth successful delineation well, H-22, was drilled at Venture, and two follow-up wells were drilled to Shell's Glenelg gas discovery of 1983, one of which flowed gas on test.

In the offshore Newfoundland-Labrador area, seven exploratory wells and three delineation wells were drilled, resulting in one oil discovery, two gas and oil discoveries and one gas-condensate find.

One of the oil discoveries, Petro-Canada et al Terra Nova K-08, flowed oil from all four zones tested at rates up to 832 cubic metres per day. An unsuccessful follow-up well 2 km west, K-18, was drilled later in the year.

Gas and oil were discovered by Mobil and partners in their South Mara C-13 well southeast of Hibernia (gas - 399 000 cubic metres per day; oil - 276 cubic metres per day), while Husky-Bow Valley found gas (567 000 cubic metres per day) and oil (97 cubic metres per day) in their Whiterose N-22 farm-out well on Mobil lands east of Hibernia.

Earlier in the year, Husky-Bow Valley found gas and condensate in the Trave E-87 well northeast of Whiterose. Three other exploratory wells in the northeast Grand Banks area were dry. Two successful delineation wells were drilled on the Hibernia structure; K-14 and C-96 were the eighth and ninth delineation wells drilled respectively.

Hudson Bay

An initial environmental screening document was prepared and environmental data were collected during the operators' 1984 seismic programs and an aerial survey of the coastal zone completed. At year end, the group proposing to drill in 1985 had begun operational planning and was preparing the submissions required under the Canada Oil and Gas Drilling Regulations.

Mainland Territories

Drilling activity in the Mackenzie Valley area of the Northwest Territories increased significantly in 1984. Fifteen exploratory wells were drilled utilizing 10 rigs. Four of these wells were suspended over the summer to be re-entered for testing after freeze-up.

Two rigs were active in the Norman Wells oil field, drilling water injection and production wells from artificial islands in the Mackenzie River for the waterflood production expansion project. One of these rigs was released from contract in September. Sixty-nine development wells were completed during the year, compared with 57 in 1983.

Beaufort Sea – Mackenzie Delta

Drilling in this region resulted in four discoveries, one of oil, one of oil and gas and two of gas, made in 10 exploratory wells drilled.

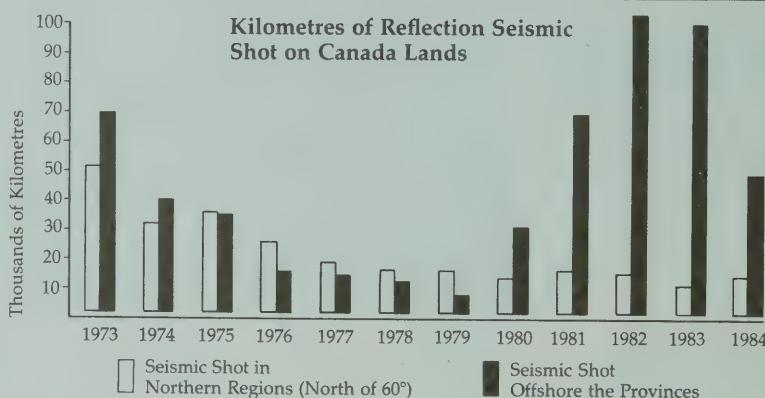
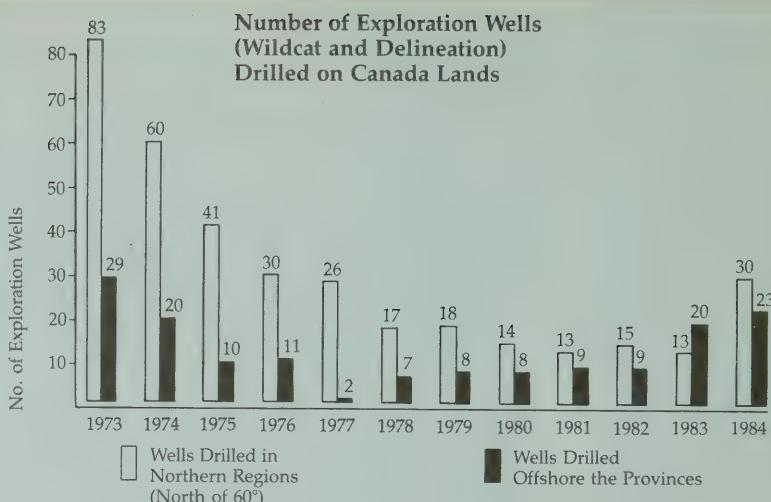
Utilizing its fleet of four drilling vessels, Dome re-entered five wells that were suspended in 1983, and drilled all to total depth. Dome also spudded one new well, Dome Nerlerk J-67, using Gulf's *Kulluk* drilling unit. This well was drilled to 2367 metres and suspended for the season. Three Dome wells were plugged and abandoned with no significant hydrocarbons, and two others were suspended until 1985 for re-entry and testing.

On lands held by Gulf Canada, two discoveries, one of oil and a second of oil and gas, were made from the *Kulluk* conical drilling unit, while a third exploratory well, drilled from Dome's SSDC caisson, was dry; a fourth exploratory well was spudded using the *Kulluk* and suspended until 1985. In July, Gulf et al Pitsiulak A-05 tested oil at rates of up to 364 cubic metres per day, and in September

Gulf's Amauligak J-44 flowed oil on one test at 822 cubic metres per day. Gulf has indicated that the latter discovery will be delineated in 1985. In addition to its exploratory drilling, Gulf drilled a delineation well at the west end of the Tarsiut structure, the fourth follow-up well to the Tarsiut A-25 discovery of 1979. This well flowed oil at 203 cubic metres per day on test of one zone.

Esso's activity included operations from four artificial islands. There was a gas discovery in the Kadluk O-07 well, flowing at rates of up to 409 thousand cubic metres per day on 6 of 22 tests run. Drilling commenced in late 1983 and this was the first well to utilize Esso's steel caisson-retained island system (SCRI) on a seabed berm. Three other offshore wells were started in the latter part of the year, including a delineation well to the Adgo oil and gas discovery of 1974. Testing of this well was in progress at year-end.

Esso and partners, led by Home Oil, also drilled two wells on the Tuktoyaktuk Peninsula. One of these, Tuk M-09, was a significant gas and condensate discovery, flowing at rates of up to 490 thousand cubic metres of gas and 147 cubic metres of condensate per day from the Lower Cretaceous Kamik formation.



Arctic Islands

In the Arctic Islands, three offshore wells were drilled by Panarctic from reinforced ice platforms, including an exploratory well in the Norwegian Bay area, and delineation wells on the Skate and Cisco structures. The exploratory well, Buckingham O-68, was reported by Panarctic to have recovered a small amount of oil. The Skate delineation well tested gas, while the Cisco follow-up was dry. Panarctic and partners also drilled an onshore exploratory well on Melville Island.

Development Activity and Production

Atlantic Offshore Venture

A preliminary development plan was submitted in January for the Venture natural gas field. During its preparation the operator, Mobil, concluded that further geological data were required. Two wells were drilled on a structure west of the field to define further the size of reserves accessible to the project. However, results from West Venture N-91 were delayed because of well control problems. The second well, West Venture C-62, was drilling at year-end. Results from the wells are expected early in 1985.

A joint federal-provincial review of environmental and socio-economic impacts, completed in 1983, culminated in recommendations to be addressed in the development plan.

In late 1984, Petro-Canada and Mobil, both senior partners in the Venture exploration group, signed conditional export contracts with U.S. firms wishing to purchase Venture gas.

Hibernia

Work continued throughout the year on the preparation of an Environmental Impact Statement (EIS) and a preliminary development plan in support of the proposed Hibernia development.

In November, the Minister of Energy, Mines and Resources agreed to a request from the Government of Newfoundland to postpone the date of filing the EIS to permit fuller consideration of alternative modes of Hibernia development.

The federal and provincial ministers also agreed to establish a joint federal-provincial review panel to conduct public hearings when the EIS is filed by Mobil.

November also saw the submission of a preliminary development plan. At year end, the options for development of the Hibernia discovery were under detailed review.

Arctic-Northern

Norman Wells

Considerable progress was made during 1984 on the \$600 million Norman Wells Expansion Project. The 160-well development project involving the construction of six artificial islands in the Mackenzie River was 95 per cent complete by year-end. A 40-km pipeline system will gather the crude oil from production wells and send it to a central plant at Norman Wells for processing before transmission to Edmonton for refining. The expansion is expected to increase recoverable reserves from about 17 per cent to more than 40 per cent of the 95 million cubic metres (600 million barrels) of oil in place, making Norman Wells the third largest oil producing field in Canada. The project is expected to begin operations by mid-1985.

The major highlights during 1984 included:

- completion of the last two production islands and associated gathering lines;
- completion of satellite facilities on four of the six production islands;

- completion and start-up of new power generation facilities, including the provision of power to the community of Norman Wells;
- commencement of water injection into the reservoir; and
- drilling of 69 development wells, bringing the number of wells drilled by year-end to 152 of the 164 new wells required for the project.

In 1985, employment and business opportunities were scheduled to shift from construction activities to those associated with the ongoing operation of the oil field. This change is expected to provide more long-term opportunities for skilled northerners and northern businesses.

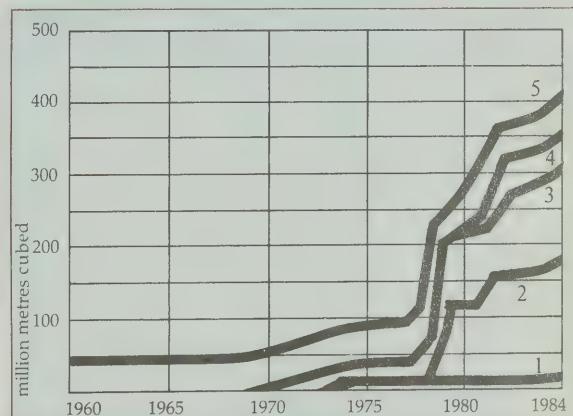
Considerable progress was also made on the Norman Wells to Zama pipeline, with completion of approximately two thirds of pipeline construction and the three pump sta-

tions. Line fill is anticipated to commence in early April 1985.

Bent Horn

In 1984, Panarctic Oils Ltd. submitted its application for development plan approval and a production licence in order to undertake the Bent Horn project. This project would involve the production of crude oil from the company's Bent Horn A-02 well on Cameron Island in the Arctic Islands, beginning in mid-1985. A two-phase project over 10 years is envisaged. Panarctic would produce and transport by tanker to southern Canadian markets about 16 000 cubic metres (100 000 barrels) per year for the first three years, increasing to about 50 000 cubic metres (300 000 barrels) for the remaining seven years.

Cumulative Total Hydrocarbon Resources Discovered Canada Lands Crude Oil and Condensate



1 Offshore Nova Scotia

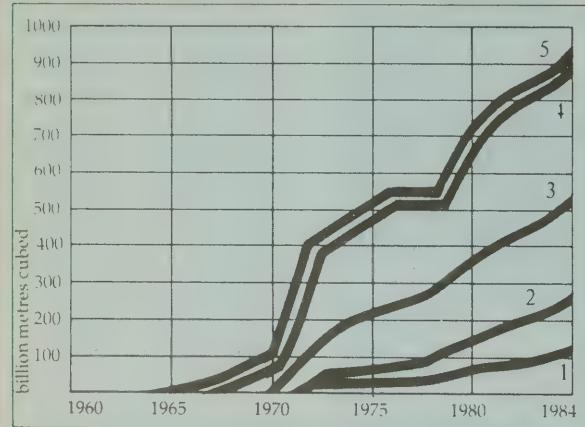
2 Grand Banks & Labrador Shelf

3 Arctic Islands & Eastern Arctic Offshore

4 Mackenzie Delta - Beaufort Sea

5 Mainland Territories

**Cumulative Total
Hydrocarbon Resources Discovered
Canada Lands Natural Gas**



- 1 Offshore Nova Scotia
- 2 Grand Banks & Labrador Shelf
- 3 Arctic Islands & Eastern Arctic Offshore
- 4 Mackenzie Delta - Beaufort Sea
- 5 Mainland Territories

This pilot project would involve the first production of crude oil in the Canadian High Arctic, with tanker shipment to market through the Northwest Passage. Following Norman Wells, which has been producing oil in the Mackenzie Valley since the 1930s, Bent Horn would be the second crude oil production project in northern Canada. It has been the subject of significant interest by local residents and the Government of the Northwest Territories, and the applicant and federal government agencies have held continuing discussions with these interested parties.

By year-end, the Minister of Indian Affairs and Northern Development had begun negotiations with the ministers of the Government of the Northwest Territories regarding mutually agreeable terms and conditions on which the Minister might approve the project.

Exploration Agreements

During 1984, negotiations were concluded for 47 exploration agreements on Canada Lands. Six of these interests were subsequently surrendered, leaving a balance of 41 new agreements for the drilling of 42 wells. The Minister and her Nova Scotia counterpart announced in December their decision to proceed with a Call for Proposals for two parcels of land in the Nova Scotia offshore area. Under the call companies will put forward competing proposals for the issuance of these lands. These proposals must address elements such as work programs, benefits and Canadian ownership. The parcels in question comprised 91 390 hectares and 72 312 hectares, respectively.

The exploration agreement confers upon the interest owner the right to explore and the exclusive right to drill the area within which the activity is to take place, as well as describing the conditions of tenure and the work program to be undertaken. Most of the current agreements require the relinquishment of a portion of the lands initially held. The amount is typically 50 per cent. The purpose of relinquishment is to focus exploratory activity and to maintain a bank of Crown reserve lands available for disposition. Although geology is the major consideration in the Crown's selection process, any special environmental consideration or other sensitivities that may be identified in a locality are also taken into account.

The quantity of Canada Lands held by industry under exploration agreements declined by about 18 million hectares during the year, to a total of approximately 112 million hectares at year end. About half of the decrease represents lands relinquished during the term of exploration agreements and voluntary surrenders make up the balance.



Cisco rig offshore at Lougheed Island.

Exploration Agreements Negotiated in 1984

Operating Company	Month Announced	Number of Agreements	Area (Million Hectares)	Location	Term (Years)	Well Commitment	Program Value (\$Million)	Canadian Content	
								National	Regional
Shell Canada	February	3	0.40	Northwest Territories	4-5	3 1	25.2	23.6	3.7
Shell Canada	February	1	0.65	Davis Strait	6	1	32.6	16.0	1.2
Sulpetro	February	1	0.19	Northwest Territories	4	1	2.6	2.08	0.5
Gulf Canada	February	2	0.59	Northwest Territories	5	2	23.2	18.8	6.0
Chevron	February	4	0.13	Northwest Territories	4-5	4	43.8	43.8	5.6
Westmin Resources	February	2	0.53	Yukon Territory	4	2	15.4	—	5.1
Dome Petroleum	February	1	0.47	Beaufort Sea	5	1	—	100.0	—
Western Decalta	February	2	0.95	Northwest Territories	4	2	6.2	4.7	0.6
Esso Resources	April	4	2.30	East Newfoundland Slope	5-6	2	200.0	102.2	44.5
Esso Resources	April	1	0.90	Labrador Sea	5	1	67.0	34.3	14.9
Amoco Canada	April	2	1.30	Grand Banks Slope	5*	2	98.0	33.3	16.2
Shell Canada	April	3	2.20	East Newfoundland Slope	5	3	96.0	41.6	28.2
Texaco Canada	April	2	0.04 0.07	Grand Banks Slope Labrador Shelf	4-5	2	75.4	29.2	14.9
Ultramar	April	2	3.00	Gulf of St. Lawrence**	4	2	68.8	30.6	13.8
Dome Petroleum	April	1	0.23	Labrador Slope	5	1	71.9	34.9	17.1
Petro-Canada	April	1	0.17	Cabot Strait North**	3	1	36.7	22.7	9.2
SAREP	April	1	0.33	Gulf of St. Lawrence**	3	1	25.9	11.8	6.5
Mobil Oil Canada	May	1	0.01	Venture	1	—	—	—	—
	May	1	0.45	Sable Island	2.5	5	284.0	142.0	60.0
Petro-Canada	May	4	0.49 0.11 0.17 0.15	Cabot Strait South** Sydney Basin** Scotian Slope Scotian Shelf	3	4	200.0	122-128	50.0
Durham Scotia Energy	May	3	0.94	Scotian Shelf	2-2.5	3	144.0	79.0	40.0
Texaco Canada	May	1	0.11	Scotian Shelf	3	1	37.5	14.4	7.5
Shell Canada	May	1	0.09	Scotian Shelf	4	1	25-36	11-16	6-9
Canadian Superior Shell Canada	August	1	0.01	Scotian Shelf	4	—	—	—	—
Western Decalta Placid Northern	November	1	0.93	Beaufort Sea	4	0	0.1	0.1	—
Ram Petroleum	November	1	0.05	South Baffin Shelf	5	1	59.0	50.7	10.1

* Optional six-year term.

** Agreements surrendered subsequently.

Offshore Safety

Improved safety practices and standards for offshore drilling units and standby vessels were implemented early in 1984. Their implementation involved close liaison with the Canadian Coast Guard to ensure that all drilling units operating in Canadian waters complied with the new standards.

Practices which were introduced throughout the industry due to the cooperation of all concerned included:

- The provision of a common traffic-monitoring centre in areas with more than one operator to track the movements of support vessels and aircraft. This ensures that the closest rescue craft can be contacted in an emergency.
- The development of specialized rescue apparatus such as the Emergency Multi-Person Rescue Apparatus (EMPRA) basket, which can be suspended below a helicopter to lift people from drilling units or from the water under certain sea conditions. Similar devices are now carried aboard all standby vessels.
- The provision of fast rescue craft on all standby vessels and drilling units to ensure a quick response in the event of emergencies.
- The establishment of qualifications standards for medical aid officers aboard drilling units and standards requiring a minimum amount of medical supplies to be kept aboard drilling units.

- The establishment of an emergency shelter and contingency base at Sable Island. The provision of a dedicated search and rescue helicopter by the industry in St. John's plus one search and rescue helicopter and a Tracker aircraft provided by the Department of National Defence for the winter operating season.
- The arrangement of common radio frequencies, amongst operators, for communication between all mobile offshore drilling units (MODUs), support craft, and government search and rescue craft during emergencies.
- Arrangements for cooperation between operators for iceberg alerts, weather forecasts and deployment of resources at times of hazard, including the establishment of a joint operators' ice centre in St. John's.
- Upgrading of alert and communications mechanisms (in cooperation with industry and the Canadian Coast Guard) to avoid possible collisions between drilling units and other sea traffic.

Contingency Planning

The Canada Oil and Gas Drilling Regulations require operators to submit contingency plans for response to emergencies that could arise during the course of operations. These emergencies include fire, damage to a rig, loss of support craft, oil spills and loss of well control. The operators are required to provide proper survival and rescue equipment and to conduct reg-

ular emergency response exercises and drills. The advice of safety advisory committees, which include representatives from the Department of Health and Welfare, the Canadian Coast Guard, the Department of National Defence and the operators, ensures that the safety and health of the offshore worker remains a primary concern.

Surveillance

To ensure greater offshore safety, COGLA inspectors and/or engineers inspect all drilling operations on an average of once every three weeks. The Canadian Coast Guard carries out additional inspections, including inspections of new drilling units prior to their departure from their respective shipyards.

A diving inspector joined COGLA during the past year. His principal responsibility was to conduct regular inspections of all diving systems in use on the drilling units operating off eastern Canada.

Search and Rescue

In December, the federal government announced that it had increased its search and rescue (SAR) capability in the Grand Banks region.

A second fixed-wing Tracker aircraft was stationed in St. John's to support one that has been assigned fisheries patrol duties. The two Department of National Defence long-range aircraft, both available to fly SAR missions, are equipped with search radar and will be upgraded to be capable of deploying self-inflating life raft and survival gear that can be dropped from the air.

During the winter months, a Canadian Armed Forces helicopter with SAR capability was deployed on a routine basis from its base in Gander to St. John's. A second backup helicopter with medical evacuation capability was also available on short notice, in addition to a King Air turboprop aircraft, chartered by Grand Banks operators, which was available exclusively for ice reconnaissance and SAR-related duties.

The Ocean Ranger

Report One of the finding of the Royal Commission investigating the *Ocean Ranger* marine disaster was issued in August. Many of the recommendations concerned training of personnel involved in offshore petroleum activity. Many of the measures recommended had been implemented through the Drilling Guidelines issued by COGLA before the release of the report. Part Two of the Royal Commission report is expected in 1985.

During 1984, removal operations were concluded at the Hibernia J-34 location, the site of the February 15, 1982 sinking of the *Ocean Ranger*. Wijsmuller Salvage BV of Holland was contracted by the rig's owner, Ocean Drilling and Exploration Co. Ltd., to remove the sunken rig and debris, with the major items being removed during the summer of 1983. In 1984, COGLA subsequently approved the termination of the debris removal program after 3000 tonnes of miscellaneous items were removed from the vicinity of the wellsite.

A special effort is being made by industry and government to undertake research into methods of evacuation in high sea conditions in response to the commission's strong recommendations concerning this matter.

Medical Advisory Committee

A medical advisory committee was established to oversee matters concerning occupational health, safety and medical support issues in offshore oil and gas activity. Initiated by COGLA, the committee includes nine doctors representing university and hospital medical faculties on the East Coast, two from the Department of Health and Welfare and two from the Canadian Petroleum Association. Guidelines considered during 1984 included standards for first aid training of industry personnel and certification of emergency medical attendants and the preparation of an inventory of medical supplies for supply-standby vessels.

Lost-Time Accidents

A lost-time accident (LTA) is an injury occurring at the work site that prevents an employee from reporting for his next regular shift. The number of LTAs per million person-hours worked is used by many industry and government agencies to compare the frequency of injury to personnel engaged in various employment sectors.

No fatalities occurred on land rigs or on board drilling units working on Canada Lands during the year. However, there were two fatalities in northern Canada associated with exploration for oil. A member of a seismic crew was killed when his bulldozer broke through the ice and a second man was killed while transferring from a supply boat to a drilling caisson. One fatality occurred on the East Coast when a member of the *Vinland* crew suffered a heart attack during an emergency evacuation.

Sea Ice and Iceberg Management

During winter months, offshore exploration activities face a harsh physical environment characterized by severe storms, freezing spray and poor visibility, including sea ice and icebergs. To combat these conditions, offshore operators have developed and implemented a comprehensive system involving detection, forecasting, control and avoidance.

Detection of ice is provided through an array of devices involving visual observations complemented by marine and airborne radar. During 1984, offshore operators logged more than 750 hours of aerial surveillance on the Grand Banks while the Atmospheric Environment Service logged more than 100 hours. Satellite systems are also utilized to provide an even wider aerial coverage although resolution is poorer than that achieved from aircraft.

During the year, sea ice and icebergs resulted in 11 drilling unit moves and 138 days of lost time, or 8.3 per cent of total available drilling days during 1984, including the following:

- In February, the threat of sea ice required the drilling unit *John Shaw* to be moved. A similar threat also delayed the spudding of the Archer K-19 well in June, and during April and May the presence of icebergs led to the occasional movement of all drilling units in the Grand Banks.

- In October, the sighting of a large iceberg in the Hibernia area resulted in an alert. However no drilling units were required to move off site.
- In early December, an iceberg moved into the drilling area, causing a multi-operator alert involving the drilling units *Sedco 706*, *Bowdrill I* and *Bowdrill III*. Although the drilling units were not required to move off site, crew levels were nonetheless reduced as a precautionary measure.

Lost-Time Accidents and Fatalities

	Lost-Time Accidents	Exposure (Person-hours)	Accident Rate (LTA/1 000 000)
Drilling Units			
North			
Arctic Islands	18	343 791	52.36
Mainland	17	832 224	20.43
Beaufort Sea – Mackenzie Delta	57	1 184 000	48.14
All North	92	2 360 015	28.98
Grand Banks	56	1 751 571	31.97
Scotian Shelf	52	2 364 360	21.99
All Canada Lands	200	6 475 946	30.88
Supply Vessels			
Grand Banks	28	688 028	40.69
Scotian Shelf	21	788 993	26.62

Emergency Measures Exercises

In September, the operators on the East Coast conducted the annual oilspill countermeasures exercise to further the training of industry response personnel. This involves the testing of procedures for the offshore containment and recovery of oil and the protection of local harbours by booms. Capability was also demonstrated by the accurate deployment of dispersant from a helicopter-mounted Rotortech dispersant bucket.

In January, COGLA, the Newfoundland and Labrador Petroleum Directorate and the East Coast operators, cooperated in an exercise designed to test the communications and decision-making systems of all parties in response to an offshore emergency. The exercise consisted of a simulated ice alert situation which progressed over time into an evacuation because of deteriorating weather. All of the participating agencies were evaluated and recommendations were made for the correction of deficiencies.

In the North, the Beaufort Sea Oil Spill Cooperative carried out its annual deployment exercise during August, held in conjunction with the Canadian Coast Guard. This was followed in September by a surprise visit of COGLA personnel to Tuktoyaktuk at the start of a harbour spill control exercise that proved to be successful.

Relief Well Capability Study

In 1984, COGLA commissioned an extensive study to assess industry's capability to conduct relief well operations anywhere on the Canada Lands. Considering contemporary logistical and drilling techniques, this study is to provide information relevant to a policy review that is to take place in 1985.

Oil-Based Drilling Muds

In 1984, a government-industry workshop was convened by COGLA to evaluate the current technology for the use of oil-based drilling muds, which are superior and less costly than more standard water-based drilling muds in certain drilling situations. This resulted in the formulation of draft guidelines allowing the use of oil-based drilling muds when special measures have been taken to protect human and environmental safety.

Compensation for Fishermen

During 1984, a compensation plan for East Coast fishermen was finalized. It encompassed the settlement of claims involving damage or loss of equipment, loss of catch or vessel, and non-attributable damages resulting from offshore petroleum activity.

This voluntary industry-funded program, developed by the Offshore Operators Division of the Canadian Petroleum Association, was the result of extensive consultation with the numerous associations representing East Coast fishermen and vessel

owners. The program will seek to address claims resulting from seafloor obstructions or debris, but which cannot be directly attributed to a particular petroleum operator.

The program provides a mechanism whereby damage claims may be settled quickly by a review board consisting of representatives from the petroleum and fishing industries.

The program, patterned after a similar successful scheme adopted for the North Sea, complements and extends existing legislation under the Oil and Gas Production and Conservation Act, which furnishes the legal basis for damage claim settlements in cases where the responsible petroleum company is readily identifiable.

Well Control Problems

During the year, there were two well control problems experienced on the Scotian Shelf. In late February, the Shell/Petro-Canada Uniacke G-72 well, located 20 km north of the eastern end of Sable Island, and drilled with the semisubmersible rig *Vinland*, encountered abnormally pressured formations containing natural gas and condensate in zones below 5190 metres. The lower part of the well had been flow tested and presumed plugged, and preparations to test higher zones containing fluid under normal pressure were under way when the well began to flow. Several mechanical failures then occurred which led to loss of well control, and the immediate evacuation of the rig. The well was brought under control 10 days after the initial incident.

A joint investigation report was issued in June by COGLA and the Canadian Coast Guard. The investigators recommended that a greater measure of well pressure security be provided in future abandonment programs for wells on the Scotian Shelf. In addition, it also advised that every drilling unit engaged on the Canada Lands be equipped with a control unit capable of effectively operating the blowout preventers, even if mechanical failures, such as those which occurred on the *Vinland*, were to occur again.

The second well control problem occurred in September at the Mobil et al West Venture N-91 well. During preparations for testing, an influx of gas into the drillpipe forced the crew to abort the operation and to evacuate the *Zapata Scotian* jack-up rig. The subsequent buildup of extremely high pressures in the well burst the casing and allowed gas and salt water from deep formation fluids to flow into low pressure shallow formations. At year-end operations were in progress to arrest the subsurface flow.

Environmental Studies Revolving Funds

Some 36 study agreements sponsored by the Environmental Studies Revolving Funds (ESRF) were initiated in 1984, for a total value of \$5.4 million. This was in addition to 37 agreements that were signed in 1983. The results of 18 studies are now in draft report form and two have been published.

Administered jointly by COGLA and the Northern Affairs Program of the Department of Indian Affairs and Northern Development, the studies are financed by means of levies on the oil and gas industry. They cover a broad range of scientific disciplines in the physical, biological and social sciences. The major field studies that commenced or took place in 1984 included:

- An investigation into the measurement of bottom sediment transport on the Scotian Shelf. This study began in the fall of 1984, and was to be completed in the spring of 1985.
- A study of the phenomenon of sea bottom ice scouring in the Beaufort Sea, caused by ice keels within drifting pack ice. At a cost of approximately \$760 000 (including charter of a survey vessel), the study will provide data of crucial importance to design criteria for undersea pipelines.
- Two field studies of the remote sensing of icebergs on the Grand Banks, each of which involved a budget of approximately \$350 000. The first, carried out in the spring of 1984, assessed the capability of rigborne radar to detect small ice masses under a wide range of sea states and the second evaluated the capability of two different types of airborne radar to detect icebergs in variable sea conditions.

- A study dealing with the behaviour and fate of hydrocarbons in the marine environment and the variety of oil spill countermeasures.
- An investigation into the difficult problem of recovering spilled oil from ice-infested waters, including tank testing of a specially built oil-skimming ship bow.
- The monitoring of effects of the operation of the oil and gas industry offshore. Aerial surveys of the distribution and abundance of marine mammals continued in the Beaufort Sea during 1984.
- Other studies, including one to identify priorities that will serve as a guide for the ESRF social studies program for the next several years; another aimed at improving communication among governments, the oil and gas and fishing industries; and a third to assist in the designing of more appropriate northern socio-economic studies in the future.

West Coast Environmental Review Panel

In June, a five-member federal-provincial panel was appointed to undertake a review of the effects of petroleum exploration in the Queen Charlotte Sound - Hecate Strait and Dixon Entrance areas offshore British Columbia. The panel studied the initial environmental evaluations earlier submitted by Chevron and Petro-Canada together with other resource documents and received comments from the public. Petro-Canada



A Sedco semisubmersible in Halifax Harbour.

informed COGLA in October that it was withdrawing from the review process.

Following public information sessions in November throughout coastal British Columbia, the panel issued in early December its final statement on requirements for additional information to government and industry. COGLA and the British Columbia Ministry of Energy, Mines and Petroleum Resources, as joint federal-provincial initiators of the project, accepted the responsibility of coordinating responses from government and industry to the panel. Public hearings are scheduled for mid-1985 and the panel is expected to present its report to federal and provincial governments later in the year.

Research and Development

COGLA's principal responsibility in relation to research and development is to work closely with other federal departments and agencies, including Public Works Canada, the National Research Council and the Atmospheric Environment Service in defining appropriate research projects.

Several major projects in R & D were carried out during 1984. They included:

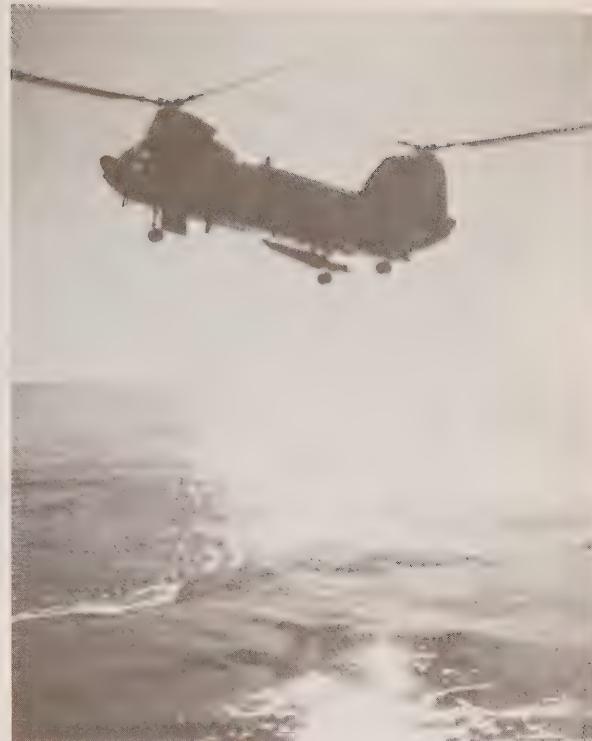
- A study into industry's capability to conduct relief well operations and minimize the environmental impact of a blowout. The study examined such factors as blowout statistics, the short- and long-term impact of blowouts, and physical operating regimes on Canada Lands.

- The development of a device similar in concept to the 'black box' in widespread use in aircraft to provide a reliable and accurate record of events over the four-hour period prior to a diving accident. The device is to be waterproof, resistant to ice damage, and will still operate in the event of power loss.
- The development of a new submersible compression chamber, or diving bell, used by divers to reach the work site. CanOcean Resources Limited of Vancouver was contracted to devise and test techniques for allowing a diver to release the bell and to control its ascent under any conditions. A prototype was built and successfully tested in July.

Beaufort Sea Environmental Assessment and Review Panel

The report of the Beaufort Sea Environmental Assessment and Review Panel was released on July 31, 1984. The report, a review of concepts for the development and production of oil and gas in the Beaufort Sea region, concluded that small-scale, phased development would be environmentally and socio-economically acceptable.

The panel made 83 recommendations concerning such issues as oil spills, damage compensation, scale of development, physical and social environment and government management of resource development. COGLA has been taking part in an interdepartmental review of this report.



A Canadian Forces Search and Rescue helicopter en route to a rescue exercise.

The objective of the Canada Benefits process is to ensure full and fair access for Canadians to the industrial, social and economic opportunities from petroleum activity on the Canada Lands.

The Process

Before the actual commencement of any work program, a benefits plan is approved outlining the benefits expected for Canada and for the specific province or territory where the activity will take place. Subsequently an annual benefits report is submitted for each calendar year during the term of the plan outlining the year's accomplishments and updating planned activities.

The plans include full and fair opportunity for Canadians to supply goods and services and to receive the employment and training opportunities related to petroleum projects. They also contain an assessment of other socio-economic implications of proposed activities on regions and local communities. In addition, affected community groups are consulted concerning the work program, the implications of the activity, and the plans or programs to enhance the benefits. Companies are also encouraged to develop special measures to enhance the participation of disadvantaged individuals.

Many interested federal departments and agencies, provincial and territorial governments, and community groups are involved with COGLA in the review of benefits plans. The information is used to assist in planning complementary programs

in support of operations and to provide an indication of possible market and employment opportunities.

Exploration Programs

Exploration activities during 1984 generated benefits to Canadians both regionally and nationally. Preliminary expenditures resulting from 1984 activity were approximately \$2.1 billion, with about 65 per cent of that amount spent in Canada. The regional content of these expenditures varied from approximately 15 per cent in the North to 25 per cent offshore the East Coast. Approximately 8600 people were directly employed in petroleum-related activities on the Canada Lands in 1984. Ninety-four per cent of the jobs were filled by Canadians and 60 per cent were filled regionally.

Development Projects

A Canada-Newfoundland task force was formed in the fall of 1984 to examine potential benefits – national and regional – associated with the development of the Hibernia oil field. Discussions with the operator, Mobil Oil, continued in the preparation of the socio-economic impact statement and Canada Benefits development plan for Hibernia.

In the Venture development project, the signing of the Venture Exploration Agreements in the Sable Island area and the submission of a development plan provided the basis for further discussions with Mobil on matters such as procurement, contracting, employment and community matters.

1984 Petroleum Exploration Expenditures on Canada Lands

— Preliminary —

	North of 60°		Nova Scotia		Newfoundland		Total Canada Lands	
	Cdn. Cdn. *\$M	Content (%)	Cdn. Cdn. *\$M	Content (%)	Cdn. Cdn. *\$M	Content (%)	Cdn. Cdn. *\$M	Content (%)
Predrilling	109	96	35	83	28	85	172	92
Drilling	471	67	358	51	292	47	1121	57
Equipment	105	79	109	70	76	65	290	72
Consumables	87	69	82	72	59	72	228	71
Services	206	97	25	98	53	94	284	96
Logistics	22	85	19	61	9	65	50	72
Other								
TOTAL	1000	78	628	55	517	57	2145	65

* Canadian dollars million

Canadian Market Opportunities Program

To make the most of domestic supplier opportunities, a planned cooperative attempt to encourage the growth and development of Canada's industrial supply base was needed. Guided by a committee with representatives from the supply community, the petroleum industry and the federal government, the Canadian Market Opportunities Program (CMOP) developed ways in which the petroleum industry could promote the purchase of Canadian manufactured goods and services.

The objectives of CMOP are to develop a consensus to achieve greater domestic production of competitive goods and services not currently being produced in this country, and to increase the domestic market share of the Canadian manufactured goods which are currently competing with foreign products.

A series of six workshops took place in 1984 across the country to discuss market opportunities for Canadian suppliers and ways to increase the purchase of Canadian goods and services. As a result of these workshops and planned future activities, a better understanding and improved dialogue is emerging between industry and government concerning the attainment of goals to build Canadian industry.

Shehtah Drilling Ltd.

Shehtah Drilling Ltd., the first native oil and gas venture in the Mackenzie Valley jointly owned by the Dene Nation, Métis Association of the N.W.T. and Esso Resources, has operated successfully since July 1983 when the company was created as an initiative of this project. Deploying a drilling rig and a service rig, the company has drilled and completed 58 wells for Esso at Norman Wells and is currently competing for other business. About 70 per cent of the company's staff of 51 are native northerners filling positions from roughnecks to operations supervisors and bookkeepers. The company has succeeded financially and expects to retire its outstanding capitalization debt by mid-1985.



The transporting of dry cargo supplies to Red Point on Melville Island

Canada–Nova Scotia Offshore Oil and Gas Board

In June 1984 the Canada–Nova Scotia Oil and Gas Agreement Acts were approved by Parliament and the Nova Scotia Legislature. The legislation established the Canada–Nova Scotia Offshore Oil and Gas Board, which was formed to manage oil and gas resource activity off the coast of the province under the terms of the Canada–Nova Scotia Offshore Agreement of March 1982.

The Administrator of COGLA has been appointed by the Minister as the Chairman of the Board, which includes two members appointed by Nova Scotia and two members appointed by the Government of Canada. The Board reviews and recommends approval to the appropriate minister of all aspects of exploration, development and production off the coast of Nova Scotia. This includes, for example, issuance of new lands, approval of exploration agreements and associated Canada Benefits plans, including benefits to Nova Scotia, the environmental and safety requirements of drilling programs, and petroleum development and production plans.

The legislation established a federal retail sales tax on designated goods, and set out the definition of offshore revenues that will be shared once production begins. It also defined how equalization offset payments will be determined; created the Canada–Nova Scotia Development Fund; extended the corporate income tax in the offshore area; and put into effect certain technical changes to the Canada Oil and Gas Act that were necessary for the proper functioning of the cooperative joint management regime.



Pictured at a recent meeting, clockwise, G.R.M. Anderson, Federal Member; Don Sherwin, Alternative Federal Member; Wynne Potter, Advisor M.E. Taschereau, Chairman; Rick Hornby, Provincial Member; Dan Whelan, Secretary; Doug Tobin, Provincial Member.

Through the Canada–Nova Scotia Environmental Coordinating Committee, ongoing liaison was undertaken with other federal government departments in the region, such as Fisheries and Oceans, Environment, the Canadian Coast Guard and the Bedford Institute of Oceanography, and Nova Scotia departments concerned, on environmental matters related to offshore oil and gas developments. In addition, the Canada–Nova Scotia Fisheries Advisory Committee provides the fishing industry with a means to direct its concerns to the Canada–Nova Scotia Board.

Canada–Nova Scotia Development Fund

The Canada–Nova Scotia Agreement Act, proclaimed in July, provided for the establishment of a \$200 million development fund to defray infrastructure costs related to resource activity in the offshore.

Contributions to the fund are advanced by the federal government in amounts of up to \$50 million per year, on the basis of approved project proposals submitted by Nova Scotia. The province will repay such advance contributions once commercial production from the offshore commences.

In the fall of 1984, expansion of the Woodside Ocean Industry Park in Dartmouth, and construction of an access road to service the Sydport Industrial Park in Sydney received final approval. Two more projects were approved in principle for a possible fund allocation of approximately \$50 million.

Sales Tax Agreement

The Canada–Nova Scotia Agreement provided that the Government of Canada would apply a retail sales tax on tangible personal property, which is used on installations involved in offshore oil and gas resources activities. The tax is intended to be the equivalent of the provincial retail sales tax, if this tax were applied to the offshore.

As the tax was not imposed until June 1984, when the Canada–Nova Scotia Oil and Gas Agreement Act was passed, the federal government agreed to pay a grant in lieu of tax for the period until the tax was in place. An amount of \$21 million was paid to Nova Scotia for that period.

The Canada–Newfoundland Negotiations

On March 8 the Supreme Court of Canada rendered a unanimous decision settling the jurisdictional dispute with the Government of Newfoundland in favour of the Government of Canada.

In November negotiations between the two governments resumed with the aim of reaching an agreement on joint management and revenue sharing related to oil and gas offshore Newfoundland and Labrador.

An agreement in principle, which was signed in June by the then Leader of the Opposition and the Premier of Newfoundland, was used as a basis for the resumption of talks in November.

At year-end discussions between the Minister of Energy, Mines and Resources and the Newfoundland minister responsible for the Petroleum Directorate continued toward the signing of an official agreement between the two governments.



Canadian supply vessel tied up at St. John's Harbour.

Photograph courtesy of Husky Oil Operations Ltd.

Gulf of Maine Boundary Dispute

On October 12, 1984 a Chamber of the International Court of Justice in The Hague, Netherlands announced its decision in the dispute between Canada and the United States regarding the maritime boundary in the Gulf of Maine area. The Chamber defined a line which establishes the maritime boundary as lying between that claimed by each of the parties. This line left the northeast portion of Georges Bank within Canadian jurisdiction.

Although drilling in the general area occurred at one time, there was mutual understanding that exploratory activity would not take place on Georges Bank while the dispute was before the World Court. Exploration on the Canadian portion of the Georges Bank may resume once fishing and related environmental concerns have been addressed.

REGIONAL STATISTICAL SUMMARY



Photograph courtesy of Esso Resources Canada Ltd.

The Canada Lands Drilling Activities



Legend

-  Plugged and abandoned
 -  Oil well
 -  Suspended for re-entry (gas well)
 -  Gas well
 -  Drilling
 -  Suspended for re-entry (oil well)
 -  Moratorium area
 -  Administrative Line of Convenience between the Department of Energy, Mines and Resources (below line) and Indian Affairs and Northern Development (above line)



1. Exco et al Cameron River L-11	25. Gulf et al Tarsiut P-45	49. Canterra PCI et al Port-au-Port J-97
2. Home et al Kakisa River J-42	26. Gulf et al Pitsiulak A-05	50. HBV et al North Ben Nevis P-93
3. Home Silt Lake A-64	27. Dome et al Natiak O-44	51. Mobil et al South Mara C-13
4. Northcor et al Trainor Lake N-25	28. Dome et al Arluk E-90	52. Mobil et al Mara M-54
5. Northcor et al Island River G-38	29. Dome et al Siulik I-05	53. Mobil et al Hibernia K-14
6. NSM Arrowhead J-69	30. Gulf et al Akpak P-35	54. HBV et al Conquest J-09
7. Northcor et al Cormack I-19	31. Gulf et al Amauligak J-44	55. VBH et al Hesper P-52
8. Northcor et al Jackfish L-63	32. Esso Home PCI et al Amerk O-09	56. Home et al Louisbourg J-47
9. Forward et al Dahadinni J-66	33. Gulf et al Kogyuk N-67	57. Home et al Citadel H-52
10. NSM Bluefish A-49	34. Dome Nerlerk J-67	58. Mobil et al Venture H-22
11. NSM Mirror Lake O-33	35. Dome et al Havik B-14	59. HBV et al Chebucto K-90
12. Petro-Canada et al Morrow Creek J-71	36. Panarctic Sherard Bay F-34	60. Shell PCI et al Glenelg E-58 & E58-A
13. Petro-Canada et al Hoosier Ridge N-22	37. Panarctic et al Cisco M-22	61. Shell PCI et al Glenelg H-38
14. Petro-Canada Sammons H-55	38. Panarctic et al Skate C-59	62. HBV et al Evangeline H-98
15. AT&S Carcajou D-05	39. Panarctic et al Buckingham B-69	63. Shell PCI et al Alma F-67
16. Exco et al West Parkin D-54	40. Mobil et al Hibernia C-96	64. Shell PCI et al South Desbarres O-76
17. Forward et al Camp M-61	41. HBV et al Voyager J-18	65. Mobil et al West Venture N-91
18. Forward et al Aubry J-13	42. HBV et al Trave E-78	66. Petro-Canada et al Dover A-43
19. Forward et al Ewekka C-11	43. HBV et al Whiterose N-22	67. Mobil et al West Venture C-62
20. Esso PCI Home et al Tuk M-09	44. HBV et al Archer K-19	68. Mobil et al West Venture B-92
21. Esso PCI Home et al Nuna A-10	45. PEX et al West Ben Nevis P-75	69. Shell PCI et al Uniacke G-72
22. Esso Trillium Adgo H-29	46. Petro-Canada et al Terra Nova K-18	70. VBH et al South Griffin J-13
23. Esso PCI Home et al Nipterk L-19	47. Petro-Canada et al Terra Nova K-08	71. PEX Texaco et al Albatross B-13
24. Esso Home et al Kadluk O-07	48. Canterra PCI et al Beothuk M-05	72. PEX et al Bonnet P-23

The Canada Lands

	1984	1983	1982	1981
Exploration agreements concluded	47	73	47	19
Seismic programs run	65	84	90	70
Kilometres of seismic shot	63 817	106 749	117 803	84 845
Drilling authorities issued	104	101	58	21
Wells spudded	120	95	55	23
Wells reached total depth	122	90	51	22
Metres drilled	241 298	187 969	120 673	94 364
Rigs active	43*	36	31	20
Dollars spent by operators (millions)				
Seismic	132.1	175.5	219.4	102.7
Drilling	2052.6	1751.3	1204.5	975.9
Total	2184.7	1926.8	1423.9	1078.6
Discovered resources**				
Gas (billion m ³)	958.6	925.4	892.8	812.6
Oil (million m ³)	408.6	478.5	469.2	413.9
Gas and oil production				
Pointed Mountain				
Gas (million m ³)	194	147	218	351
Norman Wells				
Oil (thousand m ³)	175	172	176	173

* Regional total of active rigs is 48 but 5 units worked off both Nova Scotia and Newfoundland in 1984.

** Best current estimate, including revisions to earlier discoveries.

Major Results

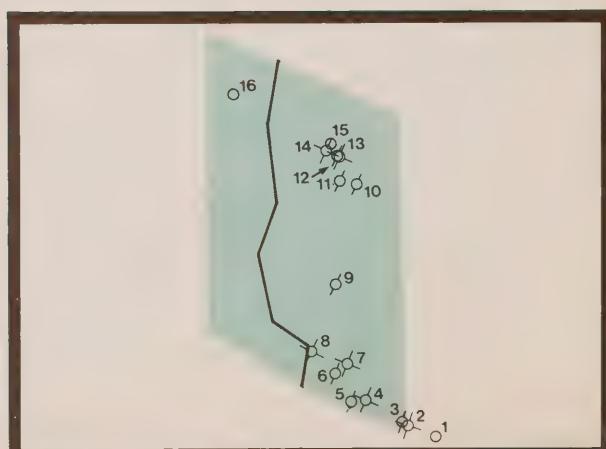
Exploration Activity	1981	1982	1983	1984
	Wells Completed	22	24	33
Significant discoveries		7	9	5
Resource Inventory	Oil (billions of barrels)		Gas (trillions of cubic feet)	
	Discovered	Potential	Discovered	Potential
Newfoundland	1.01	10.9	5.1	45.4
Nova Scotia	.11	2.0	4.3	23.4
Arctic Islands	.31	5.5	13.8	111.0
Beaufort/Delta	.82	9.2	9.9	76.0
Mackenzie Valley	.33	.6	.8	11.0
West Coast	—	.3	—	9.4
Hudson Bay	—	.8	—	3.1
Total	2.57	29.3	33.8	279.3
Total	(.41)	(4.7)	(.96)	(7.9)
	(billions of cubic metres)		(trillions of cubic metres)	

• Discovered or potential resources are not necessarily commercial at today's prices



	1984	1983	1982	1981
Exploration agreements concluded	7	27	0	7
Seismic programs run	20	12	8	2
Kilometres of seismic shot	5 371	2 720	3 500	325
Drilling authorities issued	71	62	34	4
Wells spudded	85	61	30	3
Wells reached total depth	84	60	29	2
Metres drilled	(dev.) 52 035 (exp.) 28 769	44 990 3 608	23 996 2 461	
Total	80 804	48 598	26 457	4 063
Rigs active	14	5	4	3
Dollars spent by operators (millions)				
Seismic	48.2	26.3	31.8	3.8
Drilling	(dev.) 72.1 (exp.) 49.5	24.9 12.5	31.0 21.0	3.4 0.0
Total	169.8	63.7	83.8	7.2
Discovered resources*				
Gas (billion m ³)	21.2	30.5	55.2	55.2
Oil (million m ³)	52.3	44.2	44.5	40.0
Gas and oil production				
Pointed Mountain Gas (million m ³)	194	147	218	351
Norman Wells Oil (thousand m ³)	175	172	176	173

* Best current estimate, including revisions to earlier discoveries.



Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Terminated	Status	Total Depth (m)
PCI Hoosier Ridge N-22	65° 21' 57" 127° 34' 49"	Atco Equatak # 76	84-01-31 84-04-06	Plugged & Abandoned	1095
Forward et al Camp M-61	67° 00' 56" 124° 13' 01"	Mr. Ben	84-01-03 84-01-30	Plugged & Abandoned	1145
Home et al Kakisa River J-42	60° 01' 43" 118° 38' 06"	Hi-Tower # 17	84-02-10 84-03-12	Plugged & Abandoned	1750
Northcor et al Trainor Lake N-25	60° 14' 48" 120° 34' 52"	Spartan 20	84-02-05 84-03-27	Plugged & Abandoned	2314
Northcor et al Island River G-38	60° 07' 29" 121° 34' 10"	Guthrie MacLaren # 5	84-02-14 84-04-01	Plugged & Suspended	2446
NSM Bluefish A-49	64° 58' 14" 125° 52' 45"	Peter Bawden # 1	84-01-31 84-02-27 Re-entry 84-12-08 84-12-19	Plugged & Suspended	1305
Forward et al Ewekka C-11	67° 39' 55" 126° 33' 30"	Mr. Ben	84-02-15 84-03-11	Plugged & Abandoned	1340
Forward et al Dahadinni J-66	62° 35' 44" 124° 41' 57"	Mr. Gary	84-02-12 84-03-11	Suspended	1160*
NSM Arrowhead G-69	60° 38' 32" 122° 57' 00"	Regent Rig 2	84-02-13 84-03-30	Plugged & Suspended	2500
Northcor et al Cormack I-19	60° 58' 45" 122° 32' 15"	Spartan 21	84-02-27 84-03-26	Plugged & Abandoned	1702
NSM Mirror Lake O-33	64° 52' 46" 126° 51' 17"	Peter Bawden #1	84-03-06 84-04-07	Plugged & Suspended	2026
PCI Sammons H-55	65° 24' 28" 128° 24' 45"	Atco Equatak # 76	84-03-14 84-05-20	Plugged & Abandoned	1710
Forward et al Aubry J-13	67° 12' 37" 126° 47' 40"	Mr. Ben	84-03-18 84-04-08	Plugged & Abandoned	1330
Northcor et al Jackfish L-63	60° 52' 40" 124° 27' 57"	Badger 20	84-03-24 84-09-21	Plugged & Abandoned	3010
AT&S Carcajou D-05	65° 34' 13" 128° 16' 43"	Kenting #33	84-12-22	Drilling	526
Exco et al West Parkin D-54	66° 13' 10" 137° 26' 10"	Custom Drilling #94	84-12-20	Drilling	81
PCI et al Morrow Creek J-71	65° 20' 44" 127° 28' 42"	Atco Equatak # 76	84-12-05 84-12-26	Plugged & Abandoned	1050
Home et al Silt Lake A-64	60° 03' 17" 118° 56' 36"	High Tower # 17	83-12-29 84-02-04	Plugged & Suspended	1833
Exco et al Cameron River L-11	60° 00' 38" 117° 03' 28"	Arnco # 1	84-12-23	Drilling	358

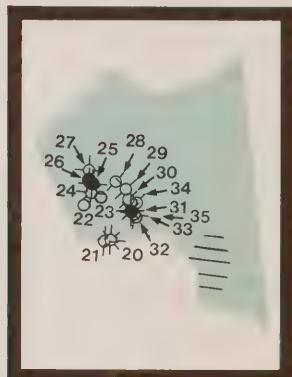
* To be re-entered for further drilling in 1985.

Mackenzie Delta–Beaufort Sea



	1984	1983	1982	1981
Exploration agreements concluded	9	9	6	0
Seismic programs run	13	9	10	11
Kilometres of seismic shot	7 959	7 684	6 355	13 052
Drilling authorities issued	6	14	7	4
Wells spudded	6	11	7	4
Wells reached total depth	11	5	7	6
Metres drilled	31 682	37 381	23 580	29 055
Rigs active	11	9	8	6
Dollars spent by operators (millions)				
Seismic	27.2	28.1	18.3	20.8
Drilling	786.4	629.8	600.0	540.0
Total	813.6	657.9	618.3	560.8
Discovered resources*				
Gas (billion m ³)	279.5	286.5	254.8	246.5
Oil (million m ³)	130.4	133.0	111.3	93.2

* Best current estimate, including revisions to earlier discoveries.



Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Terminated	Status	Total Depth (m)
Dome et al Aiverk 21-45	77°24'44" 133°42'21"	Explorer IV Explorer I Explorer I	82-11-01 Re-ent. 83-07-22 Re-ent. 84-07-27 84-10-11	Plugged & Abandoned	5034
Dome et al Havik B-14	70° 20' 11" 132° 13' 05"	Explorer III Explorer II Explorer II	83-07-17 Re-ent. 84-10-06 Re-ent. 83-09-13 84-06-29	Plugged & Suspended	4750
Dome et al Natiak O-44	70° 03' 57" 137° 13' 07"	Explorer II Explorer I	83-07-16 Re-ent. 84-09-25 84-08-30	Plugged & Abandoned	4650
Dome et al Siulik I-05	70° 24' 38" 134° 30' 40"	Explorer IV Explorer IV	83-07-25 Re-ent. 84-10-18 84-07-31	Plugged & Abandoned	4824
Dome et al Arluk E-90	70° 19' 23" 135° 26' 31"	Explorer III Explorer III	83-07-30 Re-ent. 84-10-23 84-08-01	Plugged & Suspended	4300
Gulf et al Pitsiulak A-05	69° 54' 14" 136° 45' 35"	Kulluk Kulluk	83-08-22 Re-ent. 84-07-26 84-06-18	Plugged & Abandoned	2192
Gulf et al Amauligak J-44	70° 03' 31" 133° 42' 45"	Kulluk Kulluk	83-11-16 Re-ent. 84-09-23 84-07-29	Plugged & Suspended	4002
Esso Home PCI et al Amerk O-09	69° 58' 56" 133° 30' 51"	SCRI Esso # 7	84-08-22	Testing	5000
Gulf et al Tarsiut P-45 (Tarsiut delineation)	69° 54' 55" 136° 25' 04"	Molikpaq	84-09-25 84-12-24	Plugged & Abandoned	3042
Esso Trillium Adgo H-29 (Adgo delineation)	69° 28' 23" 135° 50' 21"	Kenting 32	84-09-27	Testing	3314
Dome Nerlerk J-67 (Nerlerk delineation)	70° 26' 42" 133° 19' 29"	Kulluk	84-09-26 84-10-15	Suspended	2367*
Esso PCI Home et al Nipterk L-19	69° 48' 38" 135° 19' 53"	Esso # 3	84-10-83	Drilling	
Gulf et al Akpak P-35	70° 14' 52" 134° 09' 22"	Kulluk	84-10-17 84-11-08	Suspended	2169*
Esso Home et al Kadluk O-07	69° 46' 48" 136° 01' 14"	SCRI Esso #7	83-09-25 84-04-24	Plugged & Abandoned	3896
Gulf et al Kogyuk N-67	70° 06' 50" 133° 19' 47"	SSDC CBIR #2	83-10-28 84-01-30	Plugged & Abandoned	4798
Esso PCI Home et al Tuk M-09	69° 18' 51" 133° 02' 06"	Esso #2	83-11-18 84-03-06	Plugged & Abandoned	3030
Esso PCI Home et al Nuna A-10	69° 09' 00" 133° 15' 04"	Esso #3	83-12-21 84-02-04	Plugged & Abandoned	3250

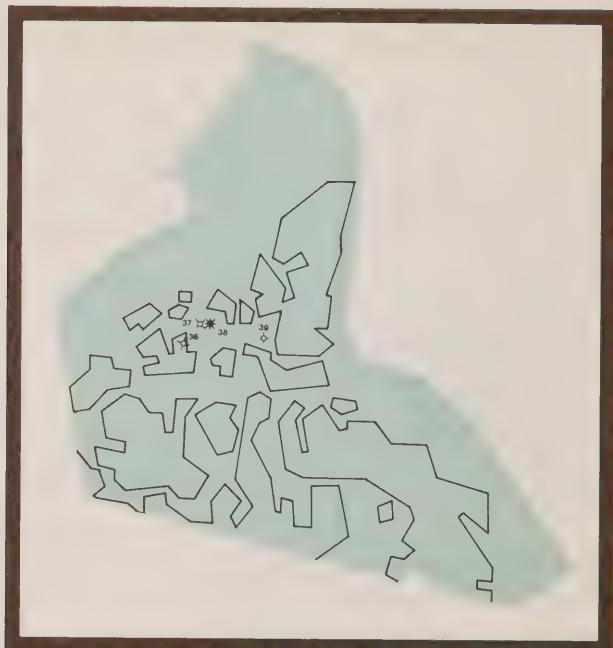
* To be re-entered for further drilling in 1985.

Arctic Islands—Eastern Arctic Offshore



	1984	1983	1982	1981
Exploration agreements concluded	3	0	21	1
Seismic programs run	1	2	6	7
Kilometres of seismic shot	601	1 142	5 126	2 425
Drilling authorities issued	3	4	6	3
Wells spudded	3	4	7	6
Wells reached total depth	4	5	6	5
Metres drilled	11 007	12 087	18 987	14 712
Rigs active	4	4	6	3
Dollars spent by operators (millions)				
Seismic	4.6	6.2	15.6	9.1
Drilling	64.0	67.8	122.5	59.5
Total	68.6	74.0	138.1	68.6
Discovered resources*				
Gas (billion m ³)	390.1	372.8	379.5	326.5
Oil (million m ³)	49.3	76.1	47.7	42.0

* Best current estimate, including revisions to earlier discoveries.

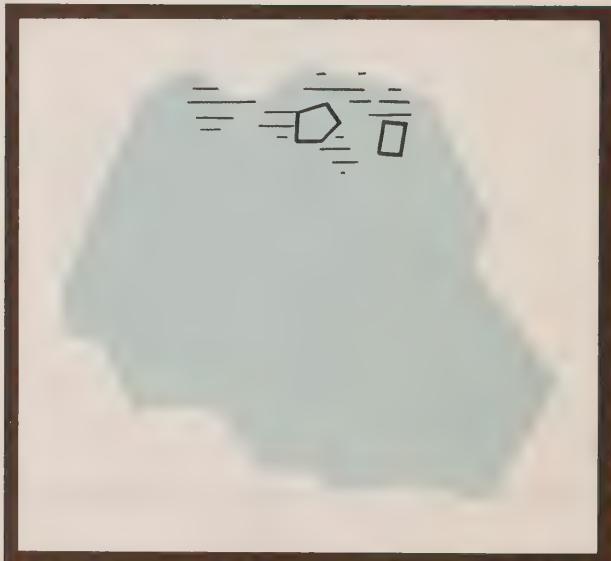


Active Wells

Name of well	Latitude, Longitude	Drilling Unit	Spudded, Terminated	Status	Total Depth (m)
Panarctic Sherard Bay F-34	76° 13' 22" 108° 43' 39"	Polaris 10	83-10-08 84-05-01	Plugged & Abandoned	5449
Panarctic et al Cisco M-22 (Cisco delineation)	77° 22' 05" 106° 10' 54"	Panarctic Rig C	84-01-22 84-04-12	Plugged & Abandoned	2367
Panarctic et al Skate C-59 (Skate delineation)	77° 48' 15" 104° 51' 28"	Panarctic Rig B	84-01-15 84-04-13	Plugged & Abandoned	2300
Panarctic et al Buckingham B-69	77° 08' 02" 91° 23' 38"	Panarctic Rig A	84-02-17 84-05-14	Plugged & Abandoned	2772



	1984	1983	1982	1981
Exploration agreements concluded	0	0	0	1
Seismic programs run	2	2	1	0
Kilometres of seismic shot	491	8 447	5 488	0
Drilling authorities issued	0	0	0	0
Wells spudded	0	0	0	0
Wells reached total depth	0	0	0	0
Metres drilled	0	0	0	0
Rigs active	0	0	0	0
Dollars spent by operators (millions)				
Seismic	1.1	7.0	6.5	0
Drilling	0	0	0	0
Discovered resources				
Gas (billion m³)	0	0	0	0
Oil (million m³)	0	0	0	0



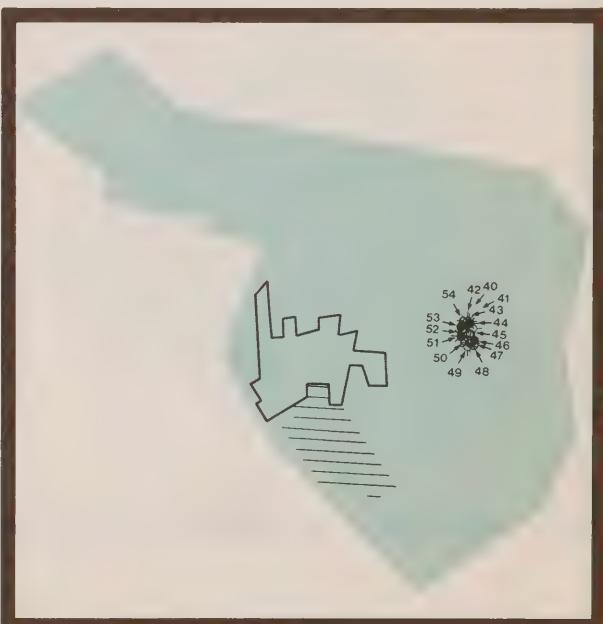
Grand Banks and Labrador Sea



	1984	1983	1982	1981
Exploration agreements concluded	13	32	0	0
Seismic programs run	12	21	33	34
Kilometres of seismic shot	27 808	48 261	61 411	41 874
Drilling authorities issued	13	9	5	8
Wells spudded	12	7	5	8
Wells reached total depth	10	9	4	8
Metres drilled	46 759	29 815	23 105	38 540
Rigs active*	9	9	7	6
Dollars spent by operators (millions)				
Seismic	27.8	57.4	71.6	43.8
Drilling	485.9	436.9	210.0	308.0
Total	513.7	494.3	281.6	351.8
Discovered resources**				
Gas (billion m ³)	145.2	126.7	124.0	124.0
Oil (million m ³)	159.9	211.5	257.5	230.5

* Five rigs worked off both Nova Scotia and Newfoundland in 1984.

** Best current estimate, including revisions to earlier discoveries.



Active Wells

Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Terminated	Status	Total Depth (m)
Petro-Canada et al Corte Real P-85	56° 04' 49"	Pacnorse I	81-10-05		
	58° 12' 09"	Neddrill II	Re-ent. 82-07-12		
		Neddrill II	Re-ent. 83-07-23		
		Neddrill II	Re-ent. 84-08-04	Plugged & Abandoned	4395
Mobil et al Hibernia C-96 (Hibernia delineation)	46° 45' 11" 48° 44' 36"	West Venture	84-01-21 84-07-14	Plugged & Suspended	4420
Husky-Bow Valley et al Voyager J-18	46° 27' 30" 48° 17' 02"	Sedco 706	84-02-26 84-06-11	Plugged & Abandoned	3743
Mobil et al South Mara C-13	46° 42' 04" 48° 32' 18"	John Shaw	84-03-21 84-10-18	Plugged & Abandoned	5034
Canterra PCI et al Port-au-Port J-97	46° 16' 38" 48° 44' 07"	Sedco 710	84-06-11 84-07-18	Plugged & Abandoned	2700
Husky-Bow Valley et al Archer K-19	46° 38' 43" 48° 02' 18"	Bowdrill III	84-06-26 84-12-15	Plugged & Abandoned	4299
Husky-Bow Valley et al Whiterose N-22	46° 51' 48" 48° 03' 56"	Sedco 706	84-06-27 85-01-04	Plugged & Abandoned	4628
Petro-Canada et al West Ben Nevis B-75 (Ben Nevis delineation)	46° 34' 01" 48° 26' 04"	Bowdrill I	84-07-18	Drilling	3922
Petro-Canada et al Terra Nova K-18 (Terra Nova delineation)	46° 27' 44" 48° 32' 31"	Sedco 710	84-07-18 84-11-21	Plugged & Abandoned	3925
Mobil et al Mara M-54	46° 43' 48" 48° 38' 43"	John Shaw	84-10-21	Drilling	
Canterra PCI et al Beothuk M-05	46° 24' 48" 48° 31' 14"	Vinland	84-11-06	Drilling	
Mobil et al Hibernia K-14 (Hibernia delineation)	46° 43' 40" 48° 47' 36"	West Venture	83-08-09 84-01-15	Plugged & Suspended	4462
Husky-Bow Valley et al Trave E-87	46° 56' 18" 47° 58' 10"	John Shaw	83-11-12 84-03-18 Re-Entry 84-06-15 84-06-26	Plugged & Abandoned	3985
Husky-Bow Valley et al Conquest J-09	47° 08' 35" 48° 15' 45"	Bowdrill II	84-11-13	Drilling	
Husky-Bow Valley et al N. Ben Nevis P-93	46° 42' 49" 48° 28, 24"	Bowdrill III	84-12-18	Drilling	
Petro-Canada et al Terra Nova K-08	46° 27' 32" 48° 30' 60"	Sedco 710	84-07-18 84-11-21	Plugged & Abandoned	4500

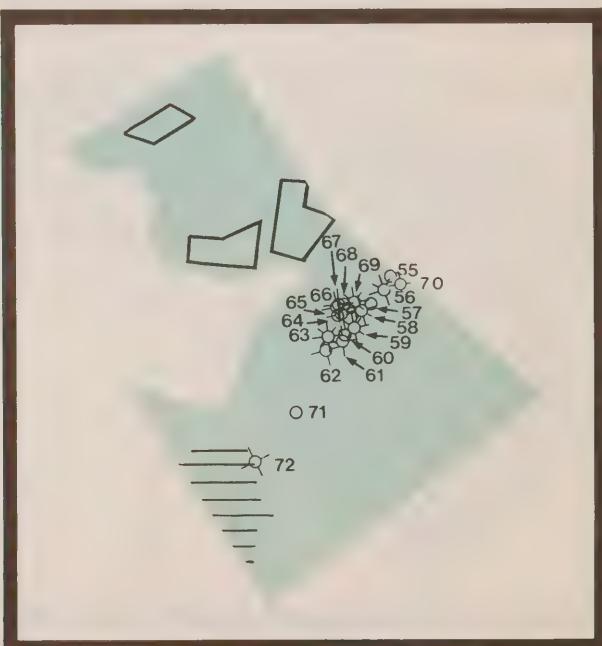
Nova Scotia Offshore*



	1984	1983	1982	1981
Exploration agreements concluded	15	5	20	10
Seismic programs run	17	38	32	16
Kilometres of seismic shot	21 587	38 495	35 923	27 169
Drilling authorities issued	11	12	6	2
Wells spudded	14	12	6	2
Wells reached total depth	13	11	5	1
Metres drilled	71 046	60 088	28 544	7 994
Rigs active	10	9	6	2
Dollars spent by operators (millions)				
Seismic	23.2	50.5	43.8	25.2
Drilling	594.7	579.4	220.0	65.0
Total	617.9	629.9	263.8	90.2
Discovered resources**				
Gas (billion m³)	122.6	108.7	79.3	60.4
Oil (million m³)	16.7	13.7	8.2	8.2

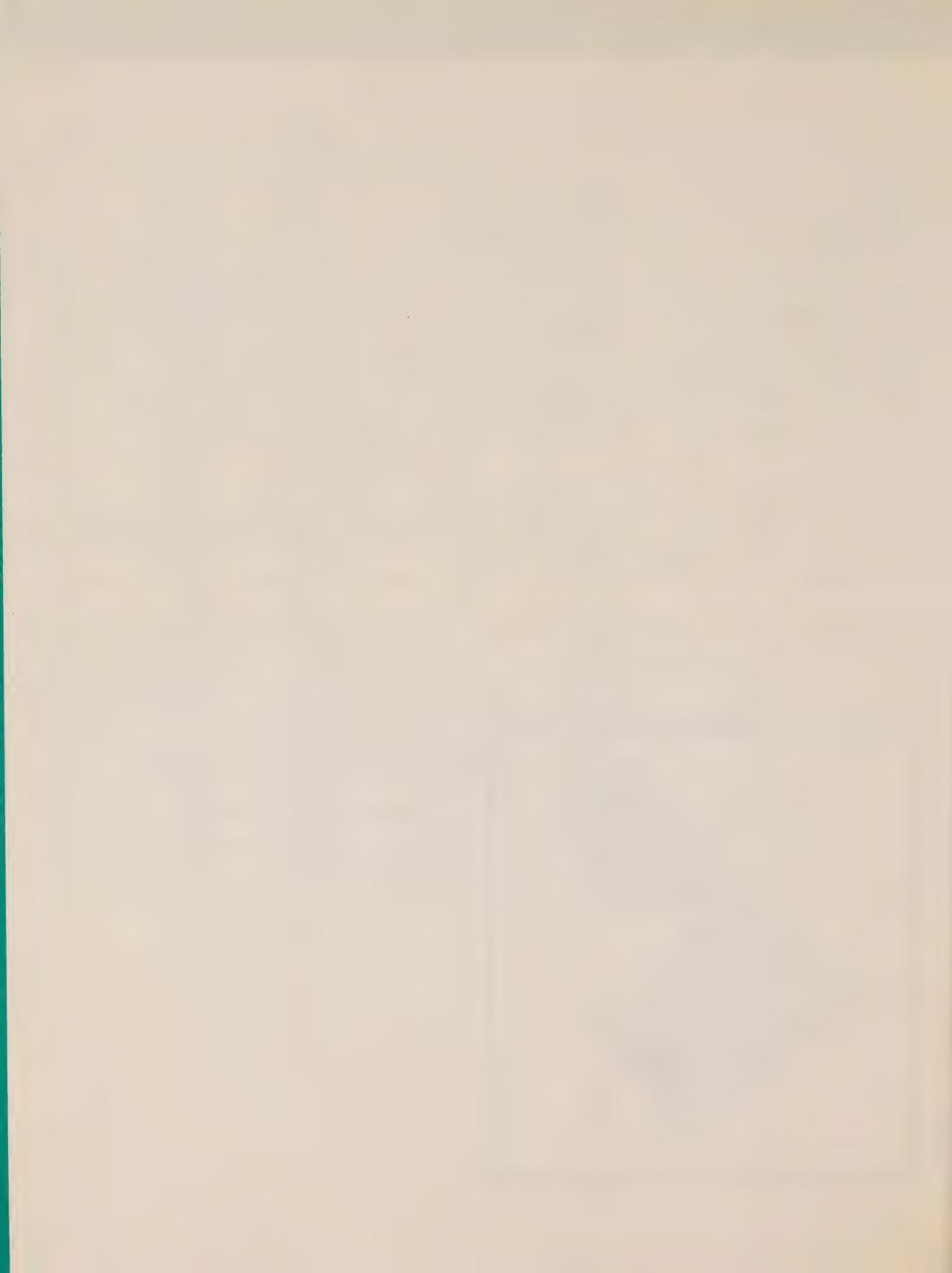
* Includes Gulf of St. Lawrence and Bay of Fundy.

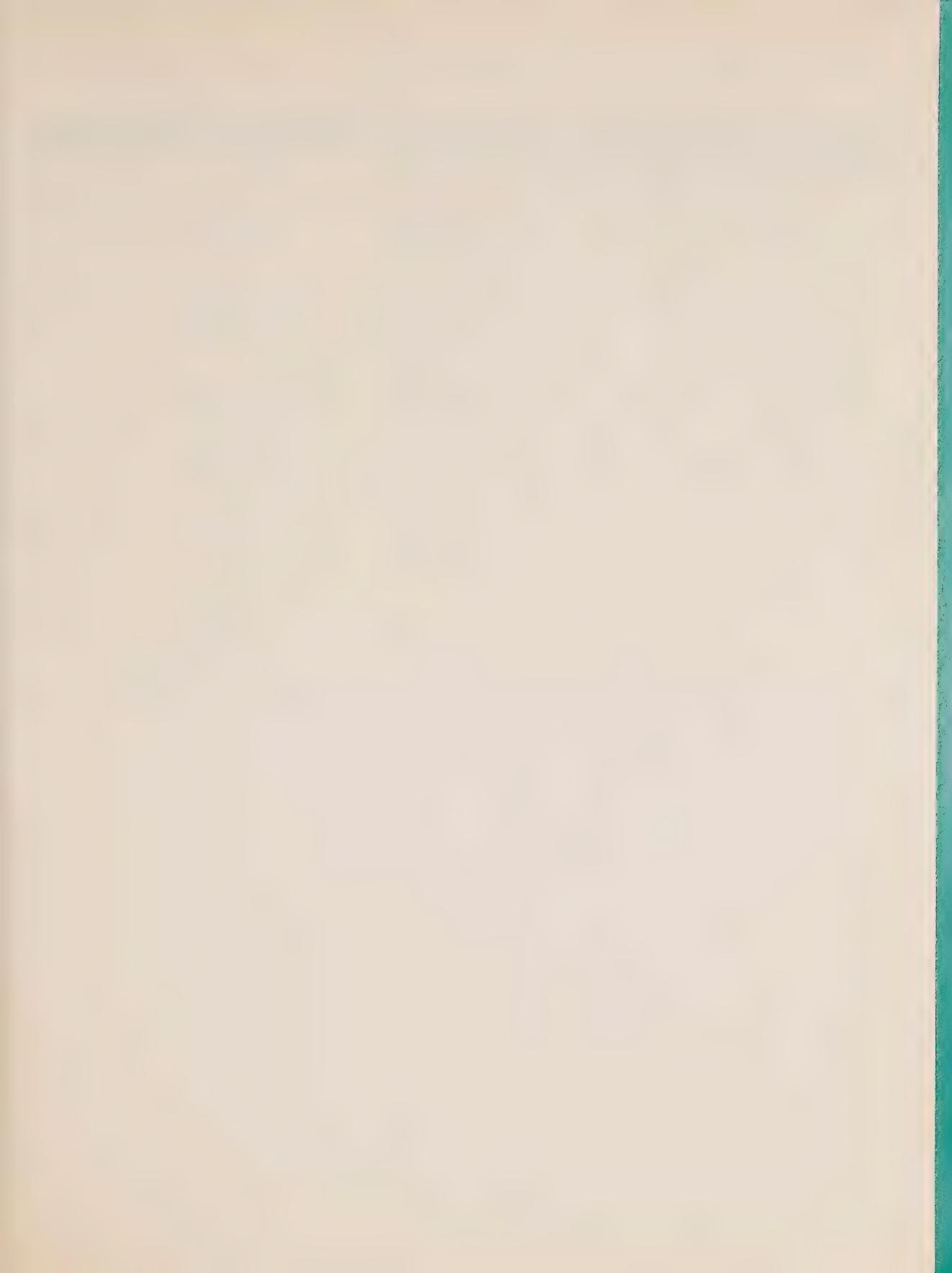
** Best current estimate, including revisions to earlier discoveries.

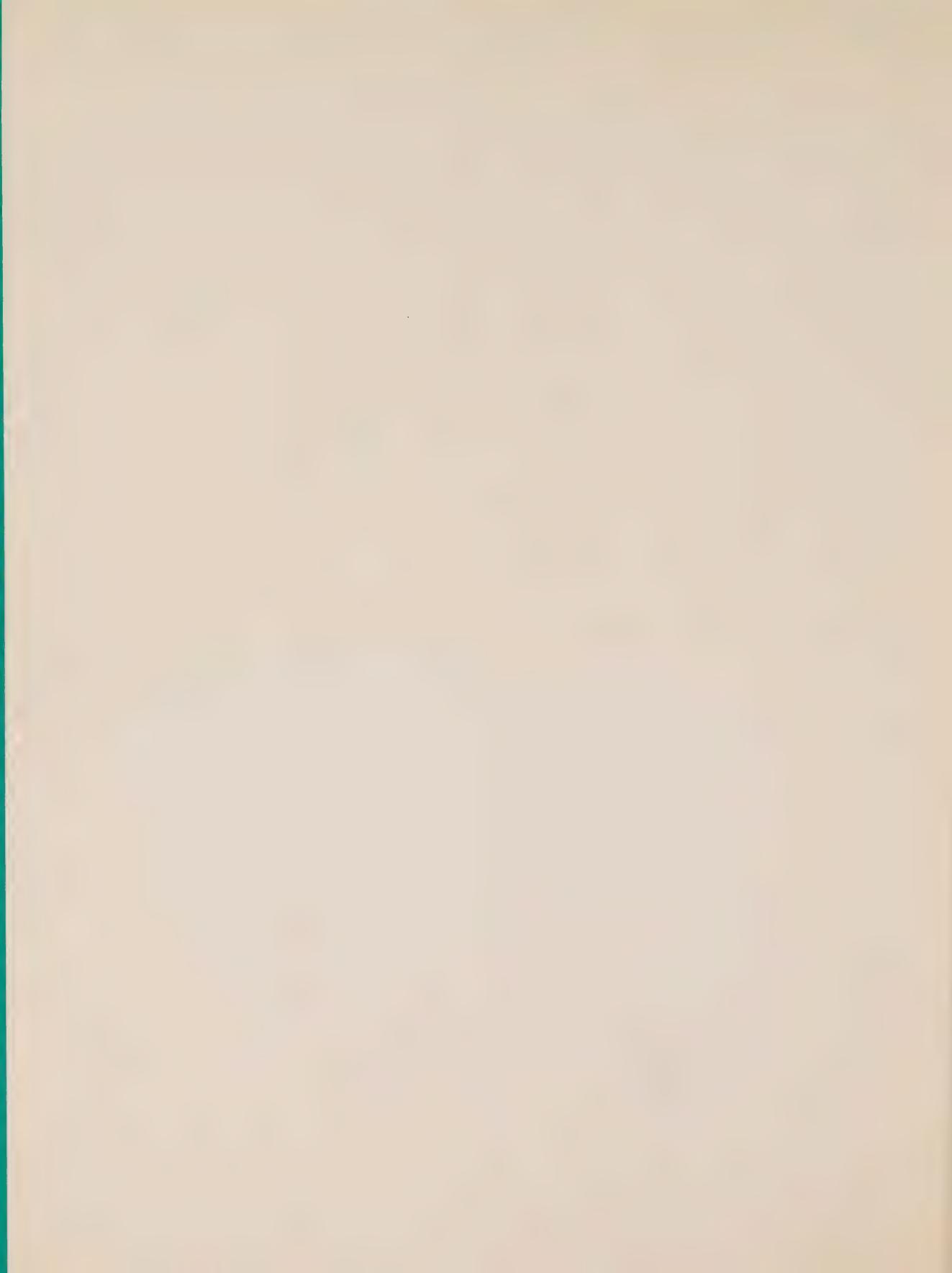


Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Terminated	Status	Total Depth (m)
Shell Petro-Canada et al Uniacke G-72	44°11'28" 59°41'10"	Vinland	83-05-09 84-04-04	Plugged & Abandoned	5735
Mobil et al Venture H-22 (Venture delineation)	44°01'24" 59°33'06"	Zapata Scotian	83-07-26 84-04-16	Plugged & Abandoned	5414
Home et al Louisbourg J-47	44°26'43" 58°21'26"	Glomar Labrador I	83-11-25 84-10-13	Plugged & Abandoned	6043
Shell PCI et al Alma F-67	43°36'18" 60°39'56"	Sedco 709	83-12-02 84-07-05	Plugged & Abandoned	5034
Husky-Bow Valley et al Chebucto K-90	43° 39' 45" 59° 42' 52"	Bowdrill II	84-01-06 84-08-02	Plugged & Abandoned	52
Bow Valley-Husky et al South Griffin J-13	44° 22' 38" 58° 01' 55"	Rowan Gorilla I	84-01-08 84-08-20	Plugged & Abandoned	5911
Petro-Canada et al Bonnet P-23	42° 22' 49" 65° 03' 02"	Bowdrill I	84-01-14 84-04-04	Plugged & Abandoned	4336
Husky-Bow Valley et al Evangeline H-98	43° 17' 27" 60° 58' 51"	Bowdrill III Bowdrill II	84-03-27 84-06-16 Re-enter 84-08-03 84-11-01	Plugged & Suspended Plugged & Abandoned	3364 5044
Shell PCI et al South Desbarres O-76	44° 05' 56" 59° 55' 59"	Vinland	84-04-16 84-10-13	Plugged & Abandoned	6039
Petro-Canada et al Dover A-43	44° 22' 09" 60° 06' 09"	Bowdrill I	84-04-17 84-07-10	Plugged & Abandoned	4525
Mobil et al West Venture N-91	44° 00' 46" 59°44' 27"	Zapata Scotian	84-04-19	(well control operations)	5547
Mobil et al West Venture C-62	44° 01' 04" 59° 40' 00"	Rowan Juneau	84-05-19	Drilling	5252
Shell PCI et al Glenelg E-58 & E-58A*	43° 37' 18" 60° 08' 52"	Sedco 709	84-07-07 84-10-20	Plugged & Abandoned	4192
Bow Valley-Husky et al Hesper P-52	44° 41' 56" 57° 52' 46"	Rowan Gorilla I	84-08-22	Drilling	5831
Mobil et al West Venture B-92	44° 01' 08" 59° 44' 59"	Glomar Labrador I	84-10-24 84-12-12	Plugged & Abandoned	72.
Shell PCI et al Glenelg H-38	43° 37' 20" 60° 04, 49"	Sedco 709	84-10-26	Drilling	4624
PEX Texaco et al Albatross B-13	42°42'11" 63°02'15"	Sedco 710	84-12-13	Drilling	4125
Home et al Citadel H-52	44° 11' 25" 58° 52' 40"	Glomar Labrador I	84-12-18	Drilling	7

* Deviation from original well E-58.







COGLA Offices

Region	Mailing Address	Street Address	Telephone	Telex	Telecopier
Headquarters	15th Floor, Tower B 355 River Road Vanier, Ontario K1A 0E4	14th Floor, Tower B 355 River Road Vanier, Ontario	(613) 993-3760	053-4366	993-9897
Maritime	2000 Barrington Street Suite 102 Halifax, Nova Scotia B3J 3K1	Cogswell Tower, Scotia Square 2000 Barrington Street Suite 102 Halifax, Nova Scotia	(902) 426-8570	019-23632	426-5253
	P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2	Bedford Institute of Oceanography Dartmouth, Nova Scotia	(902) 426-3179 426-2525	—	—
Newfoundland and Labrador	140 Water Street 5th Floor St. John's, Newfoundland A1C 6H6	140 Water Street 5th Floor St. John's, Newfoundland	(709) 772-2125	016-4031	772-2127
Northwest Territories	P.O. Box 1500 Yellowknife, N.W.T. X1A 2R3	Bellanca Building 4914 – 50th Street 6th Floor Yellowknife, N.W.T.	(403) 920-8175	034-45570	873-8707
	P.O. Box 2020 Inuvik, N.W.T. X0E 0T0		(403) 979-3006	034-44541	979-2090
Western	P.O. Box 2638 Station M Calgary, Alberta T2P 3C1	Room 482 220 – 4th Avenue, SE Calgary, Alberta	(403) 231-5631	—	—



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Publications



The Canada Oil and Gas Lands Administration

Annual
Report
1985

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Corporate Profile

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a Memorandum of Understanding between the ministers of Energy, Mines and Resources and Indian Affairs and Northern Development.

It serves as the federal government's principal point of contact with the oil and gas industry for rights disposition and operational activities on frontier lands, which include the Yukon and Northwest Territories, Hudson Bay and most of Canada's offshore areas.

COGLA's prime objective is to encourage the vigorous and responsible exploration, development and production of oil and gas on frontier lands in a manner that is safe and environmentally acceptable, and which provides Canadians full and fair access to socioeconomic benefits arising from oil and gas activity.

COGLA consists of six branches:

- The Land Management Branch
- The Engineering Branch
- The Resource Evaluation Branch
- The Environmental Protection Branch
- The Canada Benefits Branch
- The Policy Analysis and Coordination Branch

COGLA's regional offices in Halifax and Yellowknife have operational responsibility for the Maritimes and the North, respectively. COGLA's office in St. John's had operational responsibility for the Newfoundland and Labrador offshore in 1985. This responsibility was to be assumed in January 1986 by the Canada-Newfoundland Offshore Petroleum Board, established by the Atlantic Accord. The regional offices issue authorizations to drill wells and undertake geophysical and geological programs. They also conduct regular inspections and monitor engineering, geological, environmental and Canada benefits aspects of all industry operations.

Message from the Minister of Energy, Mines and Resources, the Honourable Pat Carney



Minister Pat Carney

I am honoured to submit to Parliament the fourth annual report of the Canada Oil and Gas Lands Administration (COGLA). Since 1981 COGLA has provided the regulatory framework for oil and gas activity on Canada's frontier lands, and has worked hard to earn the respect of the industry, other government departments, and the public, whose interests it helps to protect.

COGLA played an important role in helping to set up the Atlantic Accord between the Government of Canada and the Government of Newfoundland and Labrador. This historic accord, signed on February 11, 1985, established a joint management and revenue sharing regime for development of offshore oil and gas resources. The accord also illustrated a new spirit of federal-provincial cooperation with the creation of the independent Canada-Newfoundland Offshore Petroleum Board.

On October 17, 1985 Newfoundland and Labrador's Minister of Energy, William Marshall, and I were pleased to announce the appointment to the new board of the chairman, Ted Baugh, and two vice-chairmen, John Fitzgerald and Diego Henao.

As of January 1986 the new board and its staff assumed the operational responsibilities of COGLA and the Newfoundland and Labrador Petroleum Directorate for offshore oil and gas activity.

The federal and provincial legislation implementing the Atlantic Accord will become law in 1986.

Negotiations were also initiated in 1985 with the goal of achieving a similar accord between the governments of Canada and Nova Scotia to replace the existing Canada - Nova Scotia Offshore Agreement.

The Western Accord, signed by Canada and the western provinces in March 1985, signaled a new relationship between governments and industry in the development of Canada's conventional and frontier petroleum resources. The rules were changed to allow the Canadian petroleum industry to realize its full potential as a viable engine of economic growth.

On October 30, 1985, with a similar objective in mind, the Minister of Indian Affairs and Northern Development, the Honourable David Crombie, and I announced a new federal policy for frontier lands entitled Canada's Energy Frontiers: A Framework for Investment and Jobs. The legislative framework for this policy initiative will be the proposed Canada Petroleum Resources Act, which was introduced in Parliament as Bill C-92 on December 20, 1985. The new act will replace the Canada Oil and Gas Act of 1982.

The new legislation will streamline the regulatory process for oil and gas activity on frontier lands, and will eliminate the discriminatory and interventionist aspects of the previous legislation developed under the National Energy Program.

These dramatic changes were made because we listened to the provinces and to the energy industry. With these changes, we have given the industry the tools needed to do the job of developing Canada's petroleum resources on frontier lands. I am optimistic that industry will use these tools to enhance Canada's petroleum resource base and to provide jobs and economic growth for Canadians.

Another essential mandate for COGLA is protection of the worker. The Royal Commission on the *Ocean Ranger* Marine Disaster issued its second, and final, report in 1985. I am pleased to say that COGLA and other federal departments had already implemented most of the recommendations of the final report by the time it was officially released. COGLA continues to initiate research projects which increase the safety of petroleum industry workers active in offshore and onshore frontier lands. Safety of the worker must always be an important priority and the Government will make every effort to implement the recommendations of the royal commission.

COGLA continued its excellent work as the federal regulatory focus, in concert with other federal and regional agencies, for protection of the frontier environment. In particular, COGLA made valuable contributions to important environmental review hearings in British Columbia and Newfoundland-Labrador in 1985.

It has been a busy year, a year of change and consolidation. As this annual report indicates, prospects look good for the development of frontier oil and gas resources, resources which Canada needs for the future. I believe the positive changes that occurred in 1985 have enhanced the spirit of cooperation between the federal government and the provinces, and between government and industry. We all have the same goal of energy resource development. Now that the necessary and important changes have been made, we can all work confidently together to accomplish that goal.



Message from the Minister of Indian Affairs and Northern Development, the Honourable David Crombie

I am pleased to join my colleague, the Honourable Pat Carney, Minister of Energy, Mines and Resources, in the submission to Parliament of the fourth annual report of the Canada Oil and Gas Lands Administration, which acts on my behalf north of 60°.

Last September I was privileged to address the Arctic Policy conference in Montreal. I used that occasion to outline our government's approach to the North: the *inukshuks*, or guideposts, which will determine our action. These included the nurturing of community, the preservation of the environment and the creation of wealth. I believe that the oil and gas industry has made, and will continue to make, a major contribution to the North's economic growth.

The past year has been marked by milestones that vividly demonstrate this role. In May I had the pleasure of attending the official opening of the Norman Wells oil field expansion and pipeline, which was completed on time and within budget. This is the first major hydrocarbon development in the North to ship northern crude oil to southern markets.

Another highpoint was the arrival in Montreal of an oil shipment from Panarctic Oils' Bent Horn project in the High Arctic. Using a specially modified combination bulk ore and oil tanker for the first part of the journey, approximately 16 800 cubic metres of crude oil were safely shipped through the Northwest Passage to Montreal in September. Although small in scale, this project has served as a model to both industry and governments for consultation, joint planning and cooperation.

In October Miss Carney and I jointly announced a new Frontier Energy Policy. We believe it will have far-reaching benefits to both Canada and the North. To industry it offers clear rules, a fair fiscal regime and the necessary incentives to justify the costs of operating in the North. But it also commits this government to discuss with the territories joint management and resource revenue sharing, with the participation of northern aboriginal groups. This fulfills an earlier pledge to the Legislative Assembly of the Northwest Territories, when I promised to seek Cabinet support for such negotiations.

What is so exciting about these developments is how they are fitting into the approach our government is taking. During 1985 northerners and industry have moved toward a more complete understanding of one another, based upon a common desire to conserve the northern environment and respect the social fabric of northern communities. Bent Horn showed that with careful planning, the surface transportation of crude oil can be environmentally responsible. Norman Wells proved that significant economic benefits could be realized by northerners, without jeopardizing the social compact that exists within small northern communities.

All those concerned with the development of the North's hydrocarbon reserves — governments, industry, aboriginal groups, northerners — have good reason to be satisfied with the progress we have made. A continuing partnership will enable us to work out new and innovative solutions to the problems still to be overcome. Fashioning such a consensus will not be easy but it is only through consensus that real progress will be made. This approach must succeed — the rewards are simply too valuable both to the North and to Canada.



Minister David Crombie



The M.V. Arctic, first ship to transport crude from Bent Horn in the High Arctic for shipment south



Kulluk conical drilling unit with standby vessel, operating in the Beaufort Sea. Courtesy Gulf



Production facility at Norman Wells



Meeting of the Environmental Assessment Review Panel in British Columbia. Courtesy FEARO



Area administered by the Minister of Energy, Mines and Resources

Area administered by the Minister of Indian Affairs and Northern Development

Neddrill 2 drillship on its way to operate in Hudson Bay



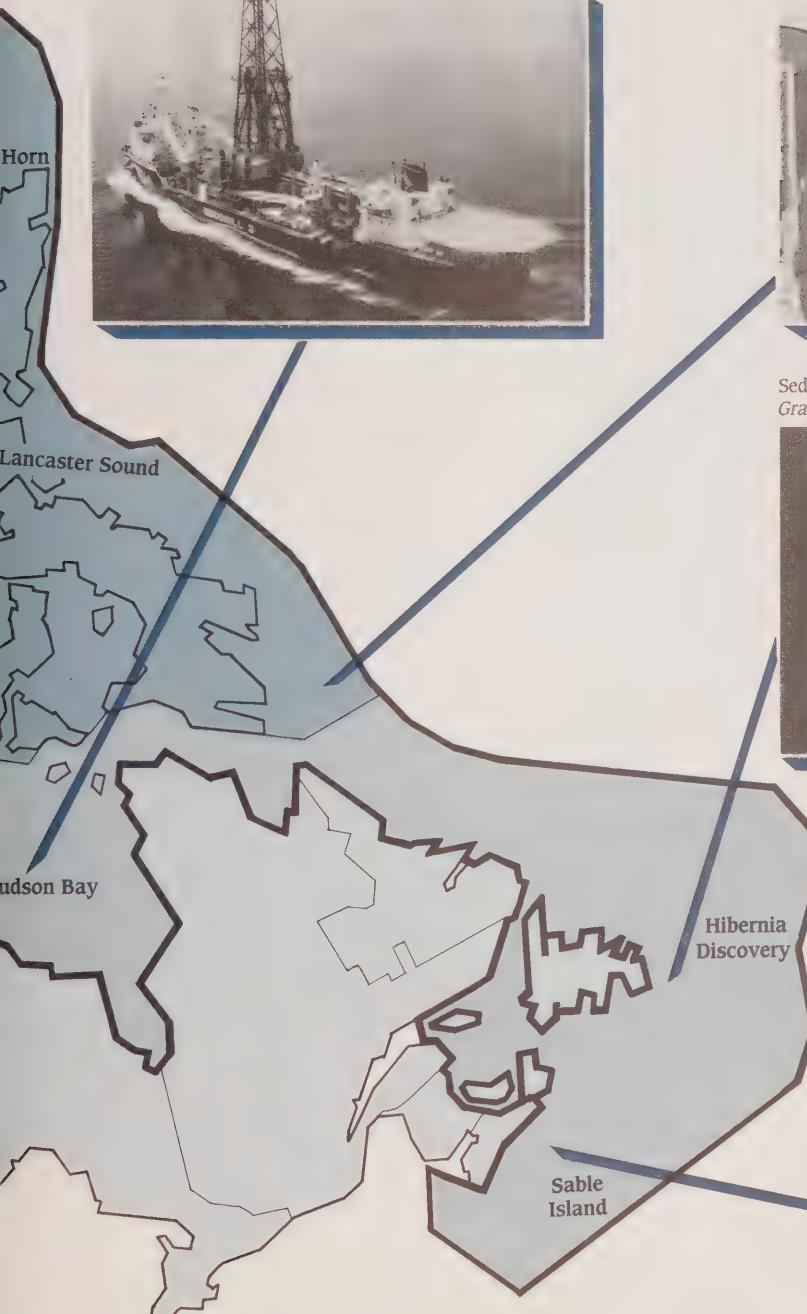
Display of marine seismic information gathering



Sedco 710 semisubmersible traveling to location on the Grand Banks. Courtesy SEDPEX



Glomar Labrador 1 jack-up rig in Halifax



A Word from COGLA's Administrator



Mr. Maurice Taschereau

The fourth edition of our annual report is a significant milestone for the Canada Oil and Gas Lands Administration. During the past four years, we have worked diligently to earn our reputation as a fair and consistent regulatory authority on Canada's frontier lands.

Since its inception, COGLA's challenge has been to administer a regulatory framework for an area twice the size of the 10 provinces. During my travels across the frontier lands, from Inuvik, Northwest Territories, through the Bent Horn project on Cameron Island in the High Arctic, to drilling units operating on the Grand Banks in the North Atlantic, I have learned that what works in one area is not always appropriate in another. In addition to the need for fair and consistent regulations, there is also a need for flexibility in developing the many regulations governing oil and gas activity on the frontier lands. COGLA has consulted extensively with the petroleum industry, with provincial-territorial governments and with other organizations to achieve this flexibility.

Another major challenge has been safety. Work in the frontier lands, whether the North Atlantic, the High Arctic, or the Beaufort Sea, occurs in some of the most hazardous environments in the world. COGLA has played an important role in sponsoring research projects that have led to significant safety improvements. Two recent and important examples include a new emergency control ascent mechanism for diving bells and the Preferred Orientation and Displacement Lifecraft Launching System (PROD), projects which came to life because of COGLA-industry cooperation.

The challenges COGLA has faced could not have been met successfully without the dedicated staff at headquarters and in the regional offices.

I would like to take this opportunity to thank all of the staff at our regional office in St. John's, Newfoundland. They were particularly helpful during the transition period leading to the assumption of operational responsibility for offshore oil and gas matters in that region by the new, independent Canada-Newfoundland Offshore Petroleum Board.

Now that COGLA has successfully resolved many of the challenges of our first four years, we look forward to the challenges of the future.



1985 Highlights



The Atlantic Accord was signed between Canada and Newfoundland and Labrador on February 11, establishing a joint resource management and revenue sharing regime for offshore oil and gas development. The accord created an independent federal-provincial Offshore Petroleum Board, which in January 1986 assumed the operational responsibilities of COGLA and the Newfoundland and Labrador Petroleum Directorate for offshore Newfoundland and Labrador. Legislation implementing the Atlantic Accord was prepared during the year and was expected to be introduced in Parliament and the Newfoundland and Labrador Legislature in early 1986.

Negotiations began between Canada and Nova Scotia during 1985 with the goal of replacing the Canada - Nova Scotia Offshore Agreement with a Canada - Nova Scotia Accord in the future.

In October 30 the federal government announced a new frontier energy policy, Canada's Energy Frontiers: A Framework for Investment and Jobs. The legislative framework for this new policy direction was the proposed Canada Petroleum Resources Act, introduced on December 20, 1985, which is to replace the Canada Oil and Gas Act of 1982.

During 1985, a total of 65 wells — exploratory and delineation — were drilled on frontier lands, a 20 per cent increase over 1984. There were 15 new significant discoveries, six in the east coast offshore and nine in the North. The most important of these discoveries were Husky/Bow Valley's North Ben Nevis find on the Grand Banks, Dome's Adlartok in the Beaufort Sea, and Esso's shallow Tuk discovery in the Mackenzie Delta.

For the first time since 1981, there were more oil discoveries than gas finds. Discovered resources of oil and gas on frontier lands increased by 15 per cent and 5 per cent, respectively, over 1984.

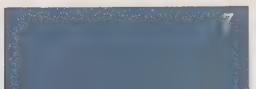
The most important exploration news in 1985 was the report of very large flows of oil on the initial tests of the first delineation well, I-65, to Gulf's promising 1984 Amauligak oil and gas discovery in the Beaufort Sea. The second zone tested was reported to have the largest oil productive capacity ever recorded in Canada.

The Norman Wells expansion project was virtually completed in 1985. Oil flowed through a new pipeline south at a rate of 3 000 cubic metres per day.

The first oil flowed south from the High Arctic in August when the Bent Horn project produced, then shipped, 16 800 cubic metres of oil from Cameron Island through the Northwest Passage to a Montreal refinery.

A federal-provincial Environmental Assessment Review Panel reviewed the Hibernia Environmental Impact Statement prepared by Mobil Oil Canada Ltd. and its partners. Its report was to be submitted to the federal and provincial governments and to the Canada-Newfoundland Offshore Petroleum Board in early January 1986.

In 1985, another federal-provincial Environmental Assessment Review Panel conducted a review of Chevron Canada Limited's and Petro-Canada's Initial Environmental Evaluation (IEE) for activity offshore British Columbia. Its report was to be submitted to the federal and provincial governments in March 1986.



1985 Highlights

Mobil submitted a Development Plan for the Hibernia project which indicated that a gravity-base production system could be on stream by the early 1990s with a projected production maximum of 24 000 cubic metres of oil per day.

During the year, Mobil and its partners in the Venture Gas Project announced agreements for the sale of natural gas with two transmission companies in the United States. In July Mobil and its partners filed an application with the National Energy Board to export 8.5 million cubic metres of gas per day from the three fields of the Venture Gas Project.

In 1985, the *Ocean Ranger* royal commission announced an additional 70 recommendations on safety in the offshore. Almost 75 per cent of these recommendations had been totally or partly implemented by the time the final report was submitted.

COGLA initiated a joint venture in 1985 with the east coast oil and gas companies to produce and test a prototype rig evacuation system. Called PROD (for preferred orientation and displacement), the prototype was built in Canada using a British company's research model. In November and December, a series of 16 tests was conducted successfully by Husky/Bow Valley on the drilling unit *Bow Drill III*, operating on the Grand Banks offshore Newfoundland. More tests are proposed for Phase Two and Phase Three of the research project in 1986.

COGLA conducted 214 inspections of drilling units in 1985 and significant progress was made in the development of regulations, contingency planning, training, search and rescue and research.

The Canada - Nova Scotia Board issued its first Call for Proposals on the east coast, and two Exploration Agreements were awarded to two consortia led by Canadian operators.

New Frontier Energy Policy

On October 30, 1985 Energy, Mines and Resources Minister Pat Carney and Indian Affairs and Northern Development Minister David Crombie announced a new frontier energy policy. A document entitled *Canada's Energy Frontiers; A Framework for Investment and Jobs* outlined a series of policy initiatives relating to resource management, royalties and Canadianization. The legislative framework for these initiatives is Bill C-92, the Canada Petroleum Resources Act, which is designed to replace the Canada Oil and Gas Act of 1982. The legislation was introduced in Parliament on December 20, 1985.

The new legislation will simplify the regulatory framework and provide a consistent legislative base for oil and gas companies operating in the frontier regions. It will also provide the basis for discussions on how these frontier initiatives will be implemented in the North.

Exploration rights are to be issued through an Exploration Licence. If a company's exploration results in the discovery of significant accumulations of oil or gas, the company would have the right to a Significant Discovery Licence. If the economics and technology favour commercial production, a Production Licence would be issued.

Under the proposed Canada Petroleum Resources Act, a simple, competitive system for issuing exploration rights to frontier lands will ensure the maximum return to Canadians as resource owners. The land issuance process is based on a single bidding criterion, with rights going to the highest bidder. The key factors in determining which bid evaluation criterion to choose in this 'best bid wins' process are geological prospectivity and policy objectives for that region of the frontier lands. Before any Exploration Licence is issued in the North, the Government of Canada will ensure that the views of native and community groups are considered. The legislation establishes a maximum term of nine years for all Exploration Licences. Direct, non-competitive issuance of rights is to be limited to exceptional circumstances.

The new bill eliminates the Crown share provisions of the Canada Oil and Gas Act, which provided for a 25 per cent share for the federal government in all interests held in the frontier lands.

The requirement for a 50 per cent Canadian ownership level is maintained for all Production Licences related to discoveries made after March 1982. If a deficiency exists when a Development Plan is submitted, the interest holder must submit a plan satisfactory to the minister showing how the Canadian ownership level is to be brought to 50 per cent by the time the Production Licence is issued. If a deficiency still exists, the minister is empowered to require a competitive auction of a share that, if purchased, will achieve the required level of Canadian ownership. Canadian companies and provincial and territorial governments will be eligible to bid for such an asset, and the federal government will have the purchase right of last resort, but never at a price less than fair market value. Alternatively, the minister may waive or postpone these requirements if the plan has been followed satisfactorily.

The bill provides authority to prescribe the royalty regime for frontier lands in relevant regulations. The current 10 per cent basic royalty and 40 per cent progressive incremental royalty are eliminated. They are to be replaced by a royalty that, before project 'payout', begins at a rate of 1 per cent of gross revenues, rising to 5 per cent in increments of 1 per cent every 18 months. Following payout of the initial investment, which includes a fair return on capital invested, the royalty will be 30 per cent of net cash flow. The definition of payout will be determined in further consultations with the industry, and provincial and territorial governments. The Governor-in-Council will be empowered to authorize the reduction or exemption of royalty payments.

As an incentive for exploration on frontier lands, a 25 per cent exploration tax credit (ETC) will be applicable to exploration expenses above \$5 million per well. In addition, a 25 per cent investment royalty credit will be applicable to eligible frontier exploratory well costs equal to, or below, \$5 million for new exploratory wells. The credit will be applied against royalties otherwise payable within the region.

Federal-Provincial and Territorial Management of the Frontier



Artist's conception of gravity-base production system proposed by Mobil for the Hibernia oil field development. Courtesy Mobil

Newfoundland and Labrador

The Atlantic Accord

A joint management and revenue sharing regime for development of offshore petroleum resources was established on February 11, 1985, when the governments of Canada and Newfoundland and Labrador signed the Atlantic Accord.

The 68 clauses of the Atlantic Accord outlined the principles of joint management and revenue sharing associated with offshore oil and gas resources located in the offshore Newfoundland and Labrador area.

The accord provides for joint management through an independent board appointed by both governments. The province has final approval over decisions of the board relating to the pace and mode of development and the right to establish and collect resource revenues as if the resources

were on land. A scheme of equalization offset payments was also included. Until national oil self-sufficiency is achieved, the Government of Canada has final approval over board decisions on the pace and mode of exploration and the pace of production. To ensure continuity and stability for the petroleum industry operating in the area, the implementing legislation will retain the provisions of existing federal legislation and regulations and will reflect the provisions contained in the proposed Canada Petroleum Resources Act, which was introduced in December 1985.

Canada-Newfoundland Offshore Petroleum Board

Under the Atlantic Accord, the two governments created the Canada-Newfoundland Offshore Petroleum Board, which is empowered to make decisions on all matters related to the management of offshore Newfoundland and Labrador oil and gas resources. The board was to assume the operational functions of COGLA and the Newfoundland and Labrador Petroleum Directorate for the Newfoundland and Labrador offshore area in early January 1986.

To ensure that the board remains responsive to both governments, the accord provides for joint policy direction to the board on key issues such as industrial and employment benefits and public reviews. The accord also provides for ministerial review of fundamental decisions affecting the pace and mode of exploration and development.

Memoranda of understanding are being developed among the federal and provincial departments and the board to ensure effective coordination and minimum duplication in the areas of fisheries, environment, benefits and marine safety.

The board will act in an advisory capacity to the federal and provincial ministers responsible for energy until legislation implementing the accord has been enacted by Parliament and the Newfoundland and Labrador Legislature.

On October 17, 1985 the federal and provincial energy ministers announced the appointment to the new board of the chairman, Ted Baugh, and two vice-chairmen, John Fitzgerald and Diego Henao. In late January 1986 four new members were appointed to the board on a part-time basis. They are: Dr. G. Ross Peters, Dean of Engineering, Memorial University; Janet Gardiner, a prominent St. John's businesswoman; William A. Deyell, a retired engineer-executive of the Nova group of companies of Calgary; and John J. Zwolinski, projects coordinator, World Bank Group of Washington, D.C.



Canada-Newfoundland Offshore Development Fund

The accord also established a joint Canada-Newfoundland Offshore Development Fund of \$300 million, which will be grant-financed by the two governments at a ratio of 75 per cent federal and 25 per cent provincial. The fund was established to help the province develop the infrastructure needed for oil and gas development, and to ensure the province reaps the socioeconomic benefits of offshore development.

Nova Scotia

The Canada - Nova Scotia Agreement

Following the signing of the Atlantic Accord with Newfoundland and Labrador in February 1985, the federal government reviewed with Nova Scotia the terms of the Canada - Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing. This agreement, which was reached in 1982, provided the basis for legislation governing management of, and sharing of revenues from, oil and gas activity offshore Nova Scotia. Detailed discussions with the province were under way at year's end on a possible new accord.

Canada - Nova Scotia Offshore Oil and Gas Board

In early 1985, under the terms of the Canada - Nova Scotia Oil and Gas Agreement of 1982, the Canada - Nova Scotia Board issued its first Call for Proposals to industry, resulting in the awarding of two Exploration Agreements. The agreements were won by two consortia led by Canadian operators: Canterra Energy Ltd.; and Husky Oil Operations Ltd. and Bow Valley Industries Ltd. The drilling programs for the two agreements represent expenditures of up to \$190 million and call for the drilling of up to four wells between 1986 and 1989.

Exploration Agreements for lands on the Scotian Shelf were close to their expiry dates in late 1985. The board extended all agreements that would have terminated in the fall of 1985 to December 16, 1985, to allow the oil companies to develop exploratory programs based on the new frontier energy policy.

During 1985 the board decided to issue a Call for Nominations in early 1986. This was to give industry an opportunity to request that specific lands in this area be included in a Call for Proposals for new Exploration Licences. The board advised industry of this decision in August 1985 so that companies could plan exploration programs for 1986. All lands offshore Nova Scotia are to be open for the Call for Nominations, including a significant portion

of the lands surrounding Sable Island, which Mobil relinquished in November 1985 and which are considered prospective for oil and gas.

In December second-round Exploration Agreements were concluded for rights to lands offshore Nova Scotia.

A resolution by a chamber of the International Court of Justice of the Canada - United States boundary dispute in the Gulf of Maine in October 1984 enabled the board to begin deliberations on petroleum exploration in the Gulf of Maine - Georges Bank area.

Since Georges Bank is a highly productive fishing area, the board advised operators holding oil and gas interests in these lands that any future negotiations of Exploration Licences under the proposed Canada Petroleum Resources Act must address fisheries and environmental issues in a very comprehensive manner.

The board maintained regular contact with Mobil during 1985 concerning its plans for the Venture natural gas project near Sable Island. Mobil focused



Gas plant facility similar to that proposed for the Venture gas field development.
Courtesy Stone and Webster Canada Ltd.



Canada - Nova Scotia Offshore Oil and Gas Board.
Front row: George Anderson, Federal Member; Maurice Taschereau, Chairman; Rick Hornby, Provincial Member.
Back row: Wynne Potter, Director General, COGLA Halifax Office; Don Sherwin, Alternate Federal Member; Jeff Carruthers, Federal Member; Al Manuel, Alternate Provincial Member.

Federal-Provincial and Territorial Management of the Frontier



Onshore rig operating in the Liard area

on proving the existence of threshold gas reserves at Venture and adjacent fields to justify development and to reassure Canadian and American regulatory authorities, and the United States gas transmission companies, the major customers for the project, that there was enough gas to support the project.

Joint Management of Northern Resources

When Indian Affairs and Northern Development Minister David Crombie spoke before the Northwest Territories Legislature in February 1985, he announced his intention to discuss with Cabinet the principle of joint resource management and revenue sharing between the federal government and the territorial governments. Mr. Crombie also said he intended to involve native peoples in the discussions on joint management and revenue sharing associated with petroleum resources.

West Coast

During public information sessions and public hearings held in 1985 throughout British Columbia by the West Coast Environmental Assessment Review Panel, COGLA worked closely with the British Columbia government and other federal and provincial agencies. Preparations were made for formal discussions in 1986 concerning a shared regulatory regime for oil and gas resources in the offshore.

Rights Management

COGLA is responsible for the issuance, registration, transfer and administration of oil and gas exploration and production rights on frontier lands on behalf of the two ministers. In the past, exploration interests for new lands have been negotiated on the basis of proposals submitted by companies in response to public calls. Under the new Frontier Lands Policy, exploration rights will be issued competitively, based on a single bidding criterion. COGLA is also responsible for collecting royalties from production on frontier lands, with the exception of the Newfoundland-Labrador offshore, where the new Offshore Petroleum Board was to assume COGLA's role in January 1986. COGLA also administers federally owned mineral rights on public lands in the provinces.

During 1985 the conversion of the remaining former permits into Exploration Agreements, pursuant to the Canada Oil and Gas Act, was completed for areas under active exploration. At year's end, COGLA was drafting nine second-round agreements for the Scotian Shelf and Slope. These agreements provide for terms of three and four years, subject to payment of annual rentals and, in some cases, specific work programs.

Also in 1985, the first Production Licence was issued for Panarctic's Bent Horn project, authorizing the first shipment of Arctic oil to southern markets.

Nine parcels of Crown reserve lands were offered for disposition through the following three Calls for Proposals in 1985:

- Call for Proposals 84-1, gazetted January 5, 1985 and closed March 7, 1985, resulted in the issuance of two Exploration Agreements for lands in the vicinity of Sable Island, offshore Nova Scotia. These agreements, numbered 269 and 270, are operated by Husky/Bow Valley and Canterra, respectively.
- Call for Proposals 86 NWT-1, gazetted December 21, 1985 and closed February 20, 1986, consisted of one parcel of land containing some 400 000 hectares near Fort Good Hope, Northwest Territories.
- Call for Proposals 86 N-1 gazetted December 28, 1985 and closed February 28, 1986, consisted of six parcels of land containing 1.4 million hectares offshore Newfoundland.

FRONTIER LAND HOLDINGS*	1981	1982	1983	1984	1985
Number of Exploration Agreements Active	0	47	120	153	150
Lands Negotiated into Exploration Agreements (Millions of Hectares)	0	35.8	25.0	21.2	24.9
Lands Relinquished or Surrendered (Millions of Hectares)	N/A	N/A	1.6	24.7	20.0
Lands Active (Millions of Hectares)	148.9	134.2	115.4	89.5	70.8

* At year's end.

LAND STATUS AT YEAR END, 1985

	Active Exploration Agreements	Lands Relinquished or Surrendered	Lands Negotiated into Exploration Agreements	Lands Active	Pending Lands**
		Millions of Hectares	Millions of Hectares	Millions of Hectares	Millions of Hectares
Mainland Territories	34	3.1	0	9.2	0.7
Mackenzie Delta and Beaufort Sea	23	1.6	0	7.3	0
Arctic Islands and Eastern Arctic Offshore	25	1.4	0.7	15.1	6.4
Hudson Bay	2	0.2	23.3	23.1	1.4
Grand Banks and Labrador Sea	38	10.9	0	11.9	3.7
Nova Scotia Offshore*	28	2.8	0.9	4.2	3.0
West Coast	0	0	0	0	8.7
Total	150	20.0	24.9	70.8	23.9

* Includes Gulf of St. Lawrence.

** 'Pending' includes areas where exploration activity has been suspended:
West Coast, Lancaster Sound, Baffin Bay, Georges Bank, St-Pierre et Miquelon, etc.

EXPLORATION AGREEMENTS NEGOTIATED IN 1985

Operating Company	Month Announced	Number of Agreements	Area (10 ³ hectares)	Location	Term (years)	Well Commitment	Program Value (10 ⁶ \$)	Canadian Content (%)	Regional Content (%)
Husky	January	1	91.00	Scotian Shelf	4	2(+1)**	110.0	51	29
Canterra	January	1	72.00	Scotian Shelf	3	1	38.0	64	34
Panarctic	February	1	.01	Bent Horn*	4	0	9.0	85	17
Canadian Occidental	June	1	22 911.00	Hudson Bay	5	1(2)	19.8	51	9
Sogepet/ICG	June	1	429.00	Hudson Bay	5	1	19.8	51	9

* Development agreement. ** Option wells.

During 1985 the preparation of draft regulations to establish the Canada Lands Registry for the various agreements and related interests in frontier lands was undertaken. After extensive consultations with industry and financial institutions, the regulations are to be promulgated and the registry will become operational in 1986.

Exploration Activity

In 1985 a total of 65 wells — exploratory and delineation — were drilled on frontier lands, an increase of 11 over 1984. Twenty-seven of these wells were in the east coast offshore, 36 were in northern regions, and two were in Hudson Bay. Drilling resulted in 15 new significant discoveries, six in the east coast offshore and nine in the North.

For the first time since 1981, the number of oil, or oil and gas, discoveries exceeded the number of gas finds.

Mainland Territories

Exploratory activity in the Mackenzie Valley south of the delta remained high for the second consecutive year.

Sixteen wildcat wells were drilled, two of which resulted in gas discoveries: one at Exco's Cameron I-16, just north of the Alberta border, and the other at Petro-Canada's Tweed Lake M-47 northeast of Norman Wells in the Colville Hills area. A third well, NSM's Arrowhead G-69, drilled in 1984 in the Ford Liard area north of British Columbia, was reentered in 1985 and also tested gas. The Tweed Lake discovery was offset by a delineation well late in the year.

Fourteen wells — three in the southern Northwest Territories, two in the Franklin Mountains west of the Mackenzie River, four northwest and southeast of Norman Wells on the Mackenzie Plain, three in the Colville Hills, and two in the Eagle Plain area of the Yukon Territory — did not encounter significant hydrocarbons.

Mackenzie Delta and Beaufort Sea

In the Mackenzie Delta - Beaufort Sea region, 16 wells were terminated — 11 exploratory and five delineation. In the offshore Beaufort, exploratory drilling resulted in three discoveries: one oil, one oil and gas, and one gas.

The first discovery of 1985 was in Esso Resources Canada Limited's Amerk O-09 well drilled from its steel caisson retained island. This well flowed gas from three of five zones tested at rates of up to 514 000 cubic metres per day. This find was closely followed by Esso's Nipterk L-19 well, which flowed oil at rates of up to 541 cubic metres per day from five separate zones, with gas recovered from a higher zone. The well was successfully offset later in the year by the L-19A delineation well, deviated to the southeast from the same artificial island.

The most important discovery of the year was made in Dome Petroleum Limited's Adlartok P-09 well in the western Beaufort Sea, where there had been very little previous drilling. Oil flowed from three of five zones tested at a combined rate of 657 cubic metres per day.

Gulf Canada Limited drilled the first delineation well, I-65, to its promising Amauligak J-44 oil and gas discovery of 1984. Oil flowed on tests of each of the first two zones at rates of 1 130 cubic metres per day and the second zone was reported to have a calculated productive capacity of 5 557 cubic metres per day, which was a record for Canada. Further evaluation of the Amauligak structure was to continue in 1986.

In other delineation drilling, the fourth step-out to Esso's Adgo H-29 oil and gas discovery of 1974 was a successful gas confirmation. At year's end, Esso was testing the fifth step-out well, Adgo G-24.

Five other Beaufort Sea wells were plugged and abandoned after no hydrocarbons were encountered. They include a delineation well to Dome's Nerlerk M-98 oil discovery, and Dome's Arluk E-90, which was drilled to total depth in 1984 and reentered for testing in 1985.

On the onshore Mackenzie Delta, the highlight of the year was the discovery of shallow oil and gas in Esso's Tuk J-29 well, drilled as a delineation well, west of the Tuk M-09 gas and condensate discovery of 1984. Oil flowed on tests of two shallower zones at rates of up to 165 cubic metres per day, and gas from three higher zones at up to 195 000 cubic metres per day. A delineation well was drilled two kilometres north of the structure and three additional delineation wells were drilling at year's end. Follow-up drilling was to be continued in early 1986 to determine the commercial potential of Esso's discovery. Five other onshore exploratory wells did not encounter hydrocarbons.



Arctic Islands and Eastern Arctic Offshore

In the Arctic Islands, Panarctic Oils Ltd. drilled three exploratory wells. Two were from ice platforms and both resulted in significant discoveries.

Cape Allison C-47, drilled offshore Ellef Ringnes Island, flowed oil at 408 cubic metres per day and gas at 743 390 cubic metres per day from the King Christian formation, the main productive zone in the Sverdrup Basin. East Drake L-06, an offshore well east of the giant Drake Point gas field, tested gas at 723 000 cubic metres per day from the Drake Point Sand, a formation stratigraphically equivalent to the King Christian formation. The third well, an onshore well on Lougheed Island, was a dry hole.

Hudson Bay

Drilling resumed in Hudson Bay in 1985 when Canterra Energy Ltd., as operator for two consortia, drilled two wells in the centre of the bay.

Although new geological data were collected, no hydrocarbons were encountered.

Grand Banks and Labrador Sea

Seven separate drilling units worked on the northeastern Grand Banks, where eight exploratory and three delineation wells were terminated.

Success rates continued to be high. Husky/Bow Valley's North Ben Nevis P-93 well, 25 kilometres east of Hibernia, was particularly exciting, flowing oil from two zones at up to 626 cubic metres per day, and gas and condensate from one zone at 475 000 cubic metres per day and 92 cubic metres per day, respectively.

Mobil, as operator for a consortium of companies, made an oil discovery with the Mara M-54 wildcat well eight kilometres southeast of Hibernia.

Oil flowed from two of three zones tested at rates of up to 122 cubic metres per day.

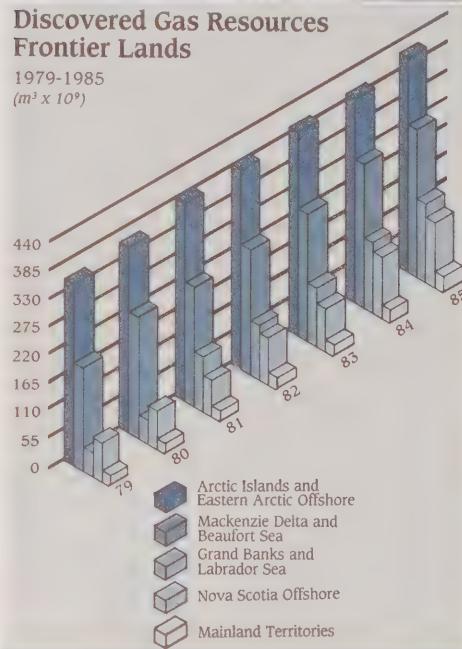
Canterra drilled the Beothuk M-05 well seven kilometres south of Petro-Canada's Terra Nova K-08 oil discovery of 1984, and tested oil from three zones at up to 228 cubic metres per day, which confirmed a southern extension to the Terra Nova field.

Petro-Canada made a significant discovery in its West Ben Nevis B-75 well between Mobil's Ben Nevis and Hebron oil discoveries of 1980 and 1981, respectively. The well flowed oil from three of four zones tested at rates of up to 955 cubic metres per day. The other four exploratory wells did not encounter hydrocarbons.

Discovered Gas Resources Frontier Lands

1979-1985

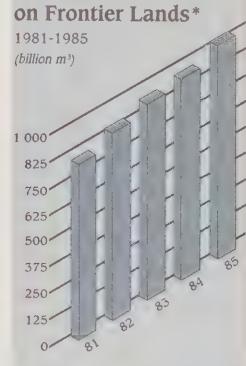
($m^3 \times 10^9$)



Cumulative Discovered Gas Resources on Frontier Lands*

1981-1985

(billion m^3)

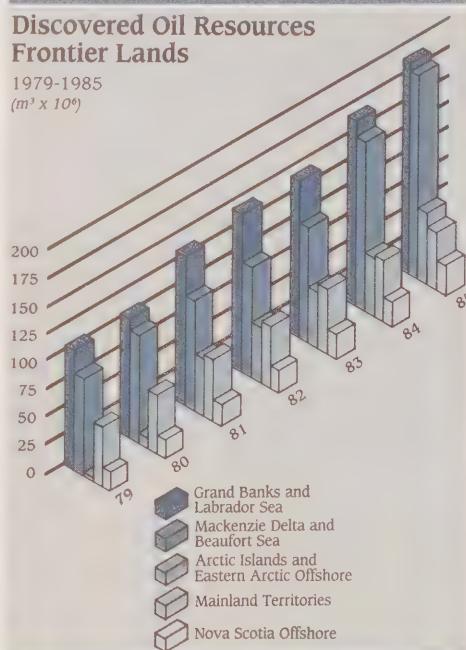


*Estimates revised to year of discovery

Discovered Oil Resources Frontier Lands

1979-1985

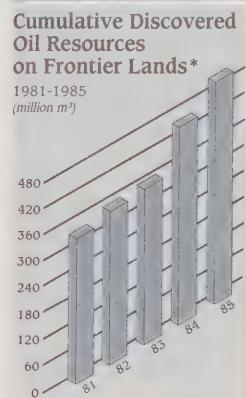
($m^3 \times 10^6$)



Cumulative Discovered Oil Resources on Frontier Lands*

1981-1985

(million m^3)

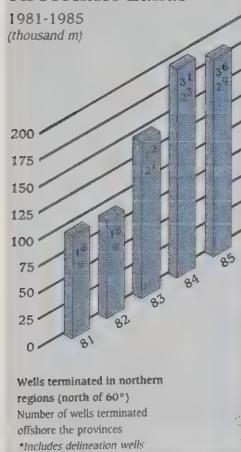


*Estimates revised to year of discovery

Exploration Activity

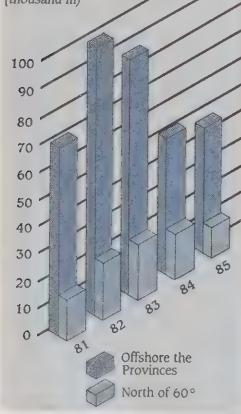
Exploratory Drilling on Frontier Lands*

1981-1985
(thousand m)



Reflection Seismic Shot on Frontier Lands

1981-1985
(thousand m)



In delineation drilling, Petro-Canada drilled a successful follow-up well to the Terra Nova K-08 discovery, but did not confirm significant hydrocarbons in an east step-out to the Hebron oil discovery at North Trinity H-71.

Husky Oil and Bow Valley Industries confirmed their Whiterose N-22 oil and gas discovery of 1984, southwest on the same structure, with a step-out well at the J-49 site.

In other drilling offshore Newfoundland, wildcats were drilled on the northeastern Newfoundland Shelf and in the deep-water Flemish Pass. No hydrocarbons were encountered.

Nova Scotia Offshore

Offshore Nova Scotia, eight separate drilling units terminated a total of 10 exploratory wells, three delineation wells and one relief well. Exploratory drilling resulted in three gas discoveries at Mobil's West Venture N-91, West Venture C-62, and West Olympia O-51. The other seven exploratory wells did not encounter hydrocarbons.

Successful gas delineation wells were drilled to Shell's Alma discovery of 1984 and in Mobil's Thebaud gas field, south of Sable Island. A delineation well on the Glenelg structure was dry.

The loss of well control at the West Venture N-91 well site in September 1984 continued into 1985 until the well was plugged and completed in June.

Development Activity

Norman Wells – Mainland Territories

The first delivery of oil to southern markets from the Norman Wells expansion project arrived in Edmonton in late April 1985, 65 years after the original discovery was made in 1920. Oil flowed through an 868 kilometre pipeline to Zama Lake, Alberta, at a rate of 3 000 cubic metres per day.

The Norman Wells expansion project was nearly completed in 1985. The central processing facility was finished and two islands, Iteh K'ee and Little Bear, were completed, bringing the number of artificial islands in the Mackenzie River to six. At year's end, Phase Two drilling activity was proceeding on schedule and is expected to be completed by mid-1986. A total of 38 wells were drilled and completed through 1985. The water flood pressure maintenance scheme was well under way, and initial pressure and production measurements indicated recoveries in line with those anticipated before the project started.

Pointed Mountain – Mainland Territories

Amoco Canada's Pointed Mountain gas field in the southern Northwest Territories was discovered in 1967. Since a gas plant was built in 1972, the field has been a steady source of natural gas, having produced more than 7 370 million cubic metres of gas by the end of 1984. With a daily capacity of 5.4 million cubic metres, the total production for 1985 was 219 million cubic metres of natural gas.

Bent Horn – Arctic Islands

In 1985, for the first time in Canadian history, oil was shipped from the Arctic Islands. The Bent Horn project, undertaken by Panarctic, was the first major step in the process of safely producing and transporting crude oil to southern markets. The 30 000 cubic metres of oil produced were from Panarctic's West Bent Horn A-02, drilled in early 1976.

Phase I of the project was initiated with Development Plan approval by the Minister of Indian Affairs and Northern Development in February 1985. Site work at Bent Horn, located on Cameron Island approximately 300 kilometres northwest of Resolute Bay, began in March. Panarctic built a four-kilometre elevated pipeline from the wellhead to a 17 200 cubic metre storage tank. Other facilities included a separating facility, a heater glycol unit and a gravity-fed loading line, 340 millimetres in diameter, from the storage tank to the shoreline loading facility.

Production started in May, and in June production rates of approximately 550 cubic metres per day had been achieved. By August the well had produced approximately 16 800 cubic metres of oil, which was loaded onto the M.V. *Arctic*, an Ice Class 2 oil carrier, for transhipment to Little Cornwallis Island. It was then transferred to the M.V. *Imperial Bedford* and shipped through the eastern part of the Northwest Passage 5 000 kilometres south to the Petro-Canada refinery in Montreal.

Hibernia – Grand Banks

Plans continued in 1985 for the development of the Hibernia discovery on the Grand Banks. The operator, Mobil Oil Canada Ltd., submitted a Preliminary Development Plan to the federal and provincial governments.

In its submission, Mobil indicated that a gravity-base system could be on stream by the early 1990s, and it projected a maximum production capacity of 24 000 cubic metres of oil per day. Detailed engineering will begin following approval of the Development Plan by the Canada-Newfoundland Offshore Petroleum Board, and after agreement on a fiscal regime.

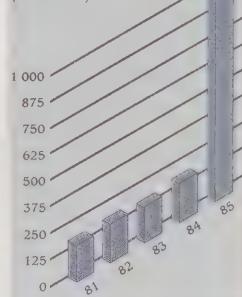
Venture – Nova Scotia Offshore

In early 1985 Mobil and its partners announced agreements with major natural gas pipeline companies in the United States for sale of Scotian Shelf gas from the Venture Gas Project. Texaco Canada Ltd., Petro-Canada and Nova Scotia Resources reached agreements with New England States Pipeline (NESP) Supply Corp., and Mobil reached a sales agreement with New Tenn Company.

In July 1985 Mobil filed an application with the National Energy Board to export 8.5 million cubic metres of gas per day originating from three fields at Venture, Thebaud and South Venture. In October 1985 the NESP Supply Corporation applied to the Economic Regulatory Agency in Washington, D.C. for permission to import natural gas from the Venture Gas Project. At year's end, the project required further confirmation of gas reserves, which will involve additional delineation and exploratory drilling during 1986.

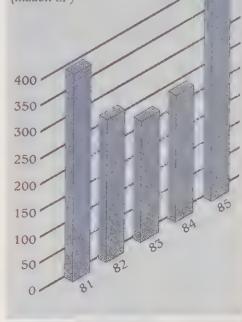
Oil Production on Frontier Lands

1981-1985
(thousand m³)



Gas Production on Frontier Lands

1981-1985
(million m³)



Protection of the Worker

Regulations

Since its inception in 1981 COGLA has administered regulations concerning the health and safety of petroleum workers on frontier lands. In 1985 discussions were initiated to extend Part IV of the Canada Labour Code to these workers. COGLA has worked with Labour Canada to tailor the Occupational Safety and Health (OSH) Regulations to workers' needs. The regulations will formalize many safety practices now in force throughout the frontier lands. The Canadian Coast Guard has a similar arrangement with Labour Canada for marine personnel.

As activity on frontier lands moved towards the development stage, and as experience with exploration activity increased, COGLA continued to develop several regulations in exploration and production, including:

- The Canada Oil and Gas Diving Regulations
- The Canada Oil and Gas Production and Conservation Regulations
- The Canada Oil and Gas Production Installation Regulations
- The Canada Oil and Gas Offshore Pipeline Regulations
- The Canada Oil and Gas Land Pipeline Regulations
- The Canada Oil and Gas Geophysical Regulations

These regulations are being formulated in consultation with industry and other government departments, and are expected to be promulgated in 1986. Similarly, the Canada Oil and Gas Drilling Regulations are being amended to incorporate the relevant recommendations of the *Ocean Ranger* royal commission, along with advances in technology and equipment.

Offshore Safety

The royal commission investigated the *Ocean Ranger* disaster, which occurred in February 1982, with the loss of all 84 crew members. It published two major reports. Part One contained 66 recommendations on offshore safety, most of which had already been implemented by COGLA and other government departments by the time the report was formally released in 1984.

The final report, released in July 1985, contained 70 recommendations. Almost 75 per cent of these recommendations had been totally or partly implemented before the report was published.

Advisory Committees

In its continuing effort to promote protection of the worker, COGLA participates on various committees. The Canada Lands Medical Advisory Committee was established in 1983 to act for industry, government and universities on matters relating to offshore health. The group assists in the drafting of COGLA regulations and directives affecting offshore health.

The Canada Lands Safety Advisory Committee, cochaired by COGLA and the Offshore Operators Division of the Canadian Petroleum Association, provides a senior forum for the review of regulations, research and development programs, search and rescue capability, training standards for offshore personnel and other related safety matters. The Department of National Defence (DND), the Canadian Coast Guard (CCG), and the Arctic Petroleum Operators Association are also represented.

Contingency Planning

Under the Canada Oil and Gas Drilling Regulations, operators are required to provide contingency plans for all foreseeable emergencies. These plans cover serious injury or death, fire, blowouts, loss or damage to the drilling unit and support craft, well control problems, pollution threats and hazards posed by ice encroachment or potential collision with other vessels.

In previous years, and again in 1985, the effectiveness of selected plans was tested by realistic field exercises that involved a single operator or, for a major exercise, government and industry resources in a particular offshore area. In February 1985 the Grand Banks operators held two emergency equipment deployment exercises in conjunction with the CCG, COGLA, and DND.

In the Beaufort Sea, Gulf, Esso and Dome continued their cooperative arrangements for search and rescue, evacuation and response procedures for emergency situations.

Inspections

As part of its responsibilities COGLA inspects each drilling unit on site, averaging one inspection per month, to assess the safety and effectiveness of unit operation in progress.

In 1985, COGLA officers conducted a total of 214 drilling unit inspections. In addition, and in accordance with the COGLA-CCG memorandum of understanding, the CCG inspected and assessed each Canadian and foreign flag drilling unit to

ensure compliance with the Canadian Standards Respecting Mobile Offshore Drilling Units. Officers from the departments of the Environment, and Fisheries and Oceans, and other departments and agencies visited rigs periodically in conjunction with COGLA inspections.

Standards for Mobile Offshore Drilling Units

Before allowing a mobile offshore drilling unit (MODU) to operate on Canada's frontier lands, COGLA requires a Letter of Compliance, or equivalent certification, issued by the CCG as evidence that the MODU complies with the Canadian standards for MODUs. This is in addition to certification issued by the country of registry and the classification society.

Rig Evacuation

The evacuation of personnel from an offshore unit during adverse weather was one of the major concerns of the royal commission investigating the *Ocean Ranger* disaster.

Since the *Ocean Ranger* accident drilling unit evacuation facilities have greatly improved. The number of lifeboats has been increased to accommodate 200 per cent of the crew; improved immersion suits are now provided in greater numbers; and improved emergency equipment on the drilling units and standby vessels have greatly increased the safety of the drilling unit and its crew.

Safety Training

During the year initial steps were taken to create an east coast Petroleum Training Accreditation Board to establish and maintain minimum safety training standards for east coast offshore operations. Composed of officials from the federal and provincial governments and from the oil and gas industry, the board's primary responsibilities would include the review, examination, monitoring and certification of safety training courses and standards.

Sea Ice and Icebergs

The 1985 ice season was one of the worst on record on the Grand Banks. Because of sea ice 312 drilling days were lost. Another 43 days were lost because of iceberg encroachment.

Effective ice management and good planning helped to reduce the effects of icebergs. At the



Esso-Parex Baccalieu I-78 site in the Flemish Pass, where icebergs appear frequently, the *Sedco 709* operated in the dynamic positioning mode, so an iceberg could move closer before forcing the drilling unit off location.

The unusual sea ice conditions during 1985 also affected the Scotian Shelf. Surveillance became necessary as the ice encroached onto the Hesper and Citadel well sites northeast of Sable Island during February and March. Although the ice cover was extensive, it was not thick or hard enough to interrupt drilling operations offshore Nova Scotia.

The open water season in the Beaufort Sea was shorter than normal and the ice retreated very slowly. This prevented testing of Dome's Havik B-41 well, but the company managed to complete testing at Arluk E-90 in the central Beaufort Sea. The large drilling barge *Kulluk* was able to terminate three wells and start a fourth, in spite of heavier than normal ice. Further west, the ice retreated enough to permit timely drilling of the Edlok and Adlartok wells by Dome-Canmar's *Explorer* drillships.

Personnel basket used to lower crew from drilling units to work boat, Nova Scotia

Protection of the Worker

Research and Development

Research and development are essential to meet COGLA's regulatory needs. Established technologies may often be used in unusual environments, but new technologies often need to be developed, assessed and implemented for Canadian conditions. In 1985 COGLA administered several major research and development projects under the Program for Energy Research and Development (PERD). It also chaired the Marine Engineering R&D Committee and was active on the Marine Transport and Offshore Impacts and Forecasting committees. PERD is a federally funded program that ensures design criteria and standards are developed to facilitate regulatory approvals of structures to be built in frontier lands. It also develops enhanced safety measures. Through this program and through membership on the R&D committees, COGLA has initiated research studies and projects on rig evacuation, diving bell innovations, survival suits and the recovery of rescue craft and lifeboats. As a member of the environmental R&D program, COGLA seeks to ensure that systems for monitoring and forecasting environmental effects are in place for offshore exploration and production units.

Emergency Control Ascent Mechanism

To enhance the safety of divers working in Canada's offshore oil and gas industry, COGLA initiated a design, construction and testing program for an emergency control ascent mechanism that can be retrofitted to a submersible diving chamber, or diving bell.

This project was funded through a PERD grant of about \$500 000, which the successful bidder, CanOcean Resources Ltd. of New Westminster, British Columbia, used to design, develop, test and assess emergency control ascent mechanisms. When this diving bell innovation is put into operation, diver safety will increase in Canada and around the world.

Emergency Heater and Marine Black Box

In 1985 COGLA was also involved in developing an emergency heater to maintain comfortable and safe temperatures in diving bells, submersibles and decompression chambers to prevent fatalities from hypothermia.

COGLA also initiated the development of an emergency automatic recording system, similar to the 'black box' used on aircraft, to record all communications and environmental data during diving operations. The new system should aid in the monitoring of diving procedures and in the investigation of diving accidents.

A Preferred Orientation and Displacement System

In 1985 COGLA cooperated with the east coast operators in the joint funding of a full-scale sea trial of an innovative lifeboat launching system aboard the *Bow Drill III*, a semisubmersible operating on the Grand Banks. The Preferred Orientation and Displacement Lifeboat Launching System (PROD), a development by the British company Water Craft Ltd., is designed to orient

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1985

	Person-Hours at Work Site		Lost-Time Accidents		Accident Rate (LTA/10 ⁶ Person-Hours)	
	Drilling Unit	Standby/Supply Vessel	Drilling Unit	Standby/Supply Vessel	Drilling Unit	Standby/Supply Vessel
Mainland Territories	431 100	N/A	11	N/A	25.52	N/A
Mackenzie Delta and Beaufort Sea	1 262 520	712 800	33	16	26.14	22.45
Arctic Islands and Eastern Arctic Offshore	195 720	N/A	5	N/A	25.55	N/A
Hudson Bay	98 040	63 360	3	3	30.60	47.35
Grand Banks and Labrador Sea	2 058 135	904 190	48	22	23.32	24.33
Nova Scotia Offshore	1 530 078	540 457	31	6	20.26	11.10
Total	5 575 593	2 220 807	131	47	23.49	21.16



a lifeboat away from the drill rig as it is being launched, and to minimize the danger of collision between the lifeboat and the drilling unit in heavy seas.

A COGLA-industry initiative in July 1985 resulted in 16 successful tests by Husky/Bow Valley of a PROD system prototype aboard the *Bow Drill III* in November and December 1985. COGLA provided 45 per cent of the \$400 000 needed for the project. East coast petroleum companies provided another 50 per cent and the governments of Nova Scotia and Newfoundland and Labrador provided the remaining funds. The CCG acted as project officer on COGLA's behalf.

Personnel Transfer Basket

In 1985 a project was initiated to develop an improved personnel transfer basket which could be used to transfer people safely from a drilling unit, or from the sea, to a standby vessel. A helicopter is used to support the basket during the transfer operation.

Arctic Escape System

The Arctic Escape System is a COGLA-CCG-industry project to develop an amphibious vehicle capable of navigating open water, ice floes and ice rubble. It will be used primarily to evacuate personnel from drilling units in the Arctic. This project is expected to produce a prototype for testing in 1986 or 1987.

Search and Rescue Capability

In 1985 the east coast operators installed a landing pad, refueling facilities, temporary accommodations and rations on Sable Island to



Abandon rig drill and firefighting exercise on the Rowan Gorilla I.

serve as a contingency base for search and rescue (SAR) operations on the Scotian Shelf. On the Grand Banks, the self-help SAR capability of the petroleum operators was reinforced in 1985 when DND stationed a dedicated SAR helicopter in St. John's. In addition, two DND Tracker long-range patrol aircraft will be assigned to St. John's for search and rescue missions in 1986.

Lost-Time Accidents

A lost-time accident (LTA) is defined as any injury that prevents a worker from returning to normal duties within 24 hours, not counting travel time or time used for diagnosis and treatment.

The number of LTAs per million person-hours worked is used by industry and government agencies to compare the frequency of injury to personnel engaged in various employment sectors.

In addition to the LTAs listed in the accompanying table, 49 others were reported on the frontier lands in exploration-related activities. However, most of these occurred in the operators' land support bases.

Of the nine fatalities associated with oil and gas exploration in 1985, only one occurred on a drilling unit.

Protection of the Environment



Stellar sea lions, Vancouver Island.

On the East Coast

Hibernia Environmental Review

In March a six-member federal-provincial panel was appointed to review the Hibernia Environmental Impact Statement (EIS) prepared by Mobil and its partners. The EIS was delivered to COGLA on May 15, 1985. The four-volume document was subsequently referred jointly by COGLA and the Newfoundland and Labrador Petroleum Directorate to the review panel.

In June the panel held public information sessions throughout Newfoundland. To facilitate the review, Mobil indicated its preferred development option, a gravity-base system, in an update to the EIS in August, and followed this with a Supplementary Information Statement to the EIS in September.

COGLA reviewed the submissions and attended the community sessions and general hearings on the EIS held during October in various Newfoundland communities, including St. John's. The panel was expected to prepare and present its report to the Canada-Newfoundland Offshore Petroleum Board in January 1986. COGLA was to review the panel report and recommendations in relation to the Hibernia Development Plan submitted by Mobil. Recommendations on the adequacy of the development plan in addressing environmental concerns were to be forwarded to the new board in 1986.

On the West Coast

Environmental Review Panel

In 1985 an environmental review panel appointed by the federal and provincial ministers of environment completed its public hearings to recommend the terms and conditions for renewing petroleum exploration in Canadian waters in the Queen Charlotte Sound - Hecate Strait and Dixon Entrance off British Columbia. COGLA and the B.C. Ministry of Energy, Mines and Petroleum Resources, as joint federal-provincial initiators of the project in February 1985, prepared information responses, developed oil spill scenarios and coordinated government responses to the panel's 1984 request for additional information. COGLA responded to panel inquiries throughout 1985 with written submissions on a variety of subjects pertinent to the review.

COGLA also attended, and participated in, the community hearings held in coastal communities throughout British Columbia, and the general hearings on the Queen Charlotte Islands, held in Prince Rupert, Vancouver and Victoria.

The panel was to present its report to the provincial and federal ministers of environment in March 1986.

In the North

Bent Horn

Panarctic obtained approval to develop the Bent Horn project in 1985. CCG reviewed Panarctic's Maritime Contingency Plan for Bent Horn, and COGLA reviewed the Development Plan. COGLA also established environmental terms and conditions for the production and transportation of oil from the Bent Horn facility in consultation with other federal and N.W.T. agencies.

Hudson Bay

Two exploratory wells were drilled in central Hudson Bay for two consortia led by Canterra. COGLA granted approval following extensive community and government consultations. During 1985 Canterra, in cooperation with the Hudson Bay Oil and Gas Committee, visited communities around Hudson Bay to explain the drilling program and outline employment opportunities. COGLA initiated this consultation program and also contributed to the review of studies conducted by the company as part of the drilling program approval. The studies included a coastal zone sensitivity analysis of Hudson Bay, a wildlife observation program, and a detailed study of the ecology of the Hudson Bay eider duck population for oil spill contingency planning.

On Canada's Frontier Lands

Guidelines

During 1985 COGLA issued guidelines on several aspects of exploration practices after comprehensive consultation with the oil and gas industry and other government departments. These included oil-based drilling mud and physical environmental guidelines.

The use of oil-based drilling muds by the oil and gas industry on an experimental basis during 1985 resulted in savings of several millions of dollars at some well sites. The oil-based drilling mud resulted in fewer problems in the well bore, and decreased the drilling time required.

Emergency Response Plan

In July COGLA published its Emergency Response Plan. This document provided the administrative framework necessary for the timely dissemination of information and consolidation of government resources in response to emergencies, including those that are a threat to the environment. Under the Canada Oil and Gas Drilling Regulations, petroleum operators are required to provide contingency plans for potential emergencies associated with their work programs.

Relief Well Capability

A study entitled *Relief Well Drilling Capability on Canada Lands* was completed for COGLA in 1985. Commissioned to assess the industry's capability to conduct relief well operations anywhere on frontier lands, the study and subsequent COGLA response will be reviewed by industry and government in 1986.

Environmental Studies Revolving Funds

The Environmental Studies Revolving Funds (ESRF), which have been administered for the past three years by COGLA and the Northern Affairs Program of Indian and Northern Affairs Canada, were consolidated and centralized at COGLA in 1985.

This was done to streamline the coordination of the funds which are raised by a levy on oil and gas companies holding interests on frontier lands.

In 1985, the ESRF's third year of operation, 40 studies were undertaken with a budget of \$4.2 million. The first 15 reports have been published and distributed and others are being prepared.



Examples of ESRF studies undertaken in 1985 include:

- Two monitoring programs, one of which concentrated on predrilling and postdrilling field samplings. The two programs were undertaken at two well sites on the Scotian Shelf and one in the Beaufort Sea, where oil-based drilling muds were used. Surveys included chemical analysis of samples and the correlation of the data with a mathematical dispersion model.
- A field program to establish a reference for studying the frequency of sea bottom impacts by icebergs and to study the actual behaviour of a scouring iceberg. It was conducted in August 1985 on Makkovik Bank off Labrador. The study will provide frequency parameters for use in analyzing risk to subsea facilities. The study provides, for the first time, data on the forces acting on a scouring berg.
- A study of northern business opportunities to determine how enterprises based in the North can play a greater role in supplying goods and services to the oil and gas industry.

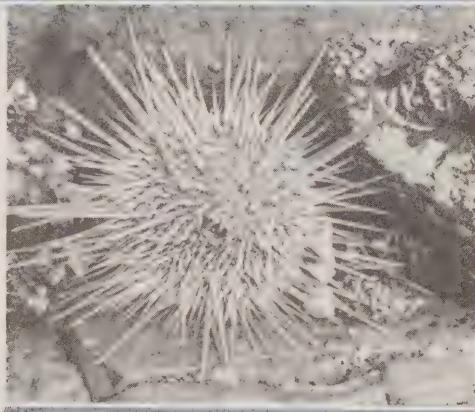
The Mahone Bay standing by in heavy seas, offshore Newfoundland. Courtesy Husky Marine Services Ltd.

Protection of the Environment



*Iceberg in Lancaster Sound,
N.W.T.*

*Sea urchin and sea star
in the intertidal zone,
Vancouver Island.*



- Two studies were initiated on the effectiveness of the application of chemical dispersants on oil slicks. They were conducted in an experimental flume tank, where environmental parameters affecting dispersant effectiveness could be simulated.
- The distribution of two whale populations was monitored in the Beaufort sea. White (beluga) whales were counted in the vicinity of the Mackenzie estuary and Tuktoyaktuk Peninsula. Surveys of bowheads, which are considered an endangered species, were conducted in the southeastern Beaufort Sea.

Offshore Incidents

West Venture N-91

The well control problem that started in September 1984 at Mobil's West Venture N-91 was successfully resolved in June 1985.

The kill operation involved installing a high-pressure snubbing unit on the drilling rig, which allowed drillpipe and other tools access into the well. To provide safe accommodation for crews working at the well, the semisubmersible *Safe Gothia* was brought in from the North Sea and anchored adjacent to the well site.

The *Safe Gothia* could also have served as a pumping platform had the need arisen. By June damaged drillpipe had been recovered and cement plugs were set in the well. The plugging program was designed to ensure that the fluids in the deep, highly pressured reservoir were permanently contained.

Following a detailed investigation of the incident, COGLA and the Nova Scotia Department of Mines and Energy prepared a report that was issued in April 1985. The report contained several recommendations, including one that stressed the need for rig supervisors and drilling personnel to receive advanced well control training.

Another report commissioned to study operating procedures, drilling practices and other measures affecting safety on the Scotian Shelf led to a joint COGLA-industry task force, which was engaged in a comprehensive examination of the report's findings at year's end.

Minuk I-53

In September 1985, as Esso neared completion of the installation of drilling and support systems at its Minuk I-53 site on a sacrificial beach island in the Beaufort Sea, a severe storm caused the erosion of 60 per cent of the island. Lasting about 70 hours, and accompanied by waves of four to five metres high, the storm was one of the worst ever recorded during 16 years of data collection in the Beaufort Sea. All personnel were safely evacuated from the island. The erosion of the island caused one of the five diesel fuel storage tanks to collapse, spilling about 380 cubic metres of P50 diesel fuel, which dispersed a few days after the incident with no apparent environmental damage. The island was repaired in October and the Minuk I-53 well was spudded on November 29. At year's end, a full report on the incident was being prepared by COGLA.

Employment and Industrial Benefits

The Canada benefits process in the frontier lands has evolved with the signing of the Atlantic Accord and the announcement of the new frontier lands policy in 1985.

Under the frontier lands policy, the Canada benefits process will be carried out differently. The application of 'full and fair access' for Canadians to opportunities arising from oil and gas activities on frontier lands will continue to be an important principle, but the process will be streamlined and become more flexible.

In 1985 COGLA presented a proposal to industry and to provincial and territorial governments for a simplified Canada benefits process for exploration activity on frontier lands. The proposal contains three major components:

- a statement of principles and procedures defining the full and fair opportunity principle and ground rules for operators on frontier lands,
- a Canada benefits plan format for describing the specific and measurable undertakings of each operator on frontier lands, and
- an annual report reviewing both past performance and ongoing action plans of operators on frontier lands.

Canadian Market Opportunities Program

During 1985 COGLA continued to work actively with the Canadian Market Opportunities Program (CMOP).

The objectives of CMOP are to increase understanding of the needs of Canada's oil and gas industry, and to increase the domestic market share of the Canadian manufactured goods competing with foreign products.

In 1985 CMOP produced a guide outlining basic purchasing policies and practices to support and encourage Canadian suppliers. The guide offered practical tips on how to conduct business with the oil and gas industry. It also provided supply-demand forecasts to the year 1990 for 14 product groups commonly purchased by the oil and gas industry, and listed relevant contacts in the industry and government.

Beaufort Industry Group

Another important step in supplier development was taken by northerners in 1985. Discussions among the oil industry, representatives of the governments of the Yukon and the Northwest Territories, and various chambers of commerce resulted in the formation of the Beaufort Industry Group. Based in Inuvik, with support both in the Northwest Territories and the Yukon, the group successfully promoted and carried out the BIG '85

tradeshow in Inuvik in May 1985, which attracted more than 100 firms.

Development Projects

During 1985 several development projects on frontier lands resulted in benefits for Canada and Canadians. COGLA reviewed the Canada benefits plans for three development projects — Bent Horn in the Arctic, and Venture and Hibernia on the east coast.

At the Norman Wells oil field expansion project, officially opened in May 1985, benefits related to northern employment, training opportunities and business growth greatly exceeded original estimates.

For the Bent Horn project, Indian Affairs and Northern Development Minister David Crombie approved the benefits plan in February 1985, subject to satisfactory plans for the employment of northerners and consultations on northern business opportunities.

The community of Arctic Bay was the focus of most of the increased employment for northern residents stemming from the project's construction. The company employed 15 residents of the community at the Bent Horn site during the short construction period.

COGLA, along with the Nova Scotia Department of Development and advisory departments, investigated ways to secure benefits for Nova Scotians and other Canadians from the Venture Gas Project. As part of this work, discussions were held with Mobil representatives regarding technology transfer in engineering and opportunities for the fabrication industry.

Measures contained in the Atlantic Accord are intended to ensure that Newfoundlanders and other Canadians reap the economic benefits of offshore development. Joint federal-provincial working groups were created to evaluate and establish priorities for fabrication, equipment, services and material supply opportunities.

COGLA and the Newfoundland-Labrador Petroleum Directorate established a benefits assessment group to guide the preparation for the Hibernia Benefits Plan. Discussions were also held with Mobil concerning two contracts that were to be awarded in 1986. One contract involves overall project management along with engineering and procurement for the topside facilities. The other is for construction of the gravity-base structure. COGLA also participated in discussions held with Canadian and international bidders to assess their capability to undertake this work in Canada.



Men working on rigs, Mackenzie Delta. Courtesy Petro-Canada

Employment and Industrial Benefits

Initiatives by Industry

COGLA continued to encourage industry initiatives that provide employment and economic benefits for Canadians living in or near the frontier lands where oil and gas activity takes place. The following are examples of such initiatives.

North

- In 1985 two native groups, through a purchase/lease-back arrangement with Petro-Canada, established businesses that provided camp facilities for seismic and drilling operations.

East Coast

- Mobil worked closely with Atlantic Airways, a Newfoundland company, in developing an aerial ice surveillance service for use in search and rescue and oil spill tracking.
- Husky/Bow Valley held a seminar in Halifax for representatives of shipbuilding and metal fabrication companies to discuss the opportunities and requirements associated with rig and supply vessel repairs and maintenance.

- In Nova Scotia, CanOcean, a subsidiary of Novacorp International Consulting Ltd., and an affiliate of Husky Oil Operations Ltd., joined Cameron Iron Works of Houston, Texas to manufacture and repair subsea equipment.
- Hi-point Peat Limited, an affiliate of Husky Oil Operations Ltd., is producing an absorbent material, at its plant near Bishop's Falls, Newfoundland, to be used for oil spill clean-up.

TOTAL 1985 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total* Work Force	Canadian	Per cent Canadian
Mainland Territories (Yukon and NWT)	1 823	1 823	100.0
Mackenzie Delta and Beaufort Sea	3 162	3 147	99.5
Arctic Islands and Eastern Arctic Offshore	251	251	100.0
Hudson Bay	351	296	84.0
Grand Banks and Labrador Sea	2 856	2 669	93.5
Nova Scotia Offshore	2 285	2 083	91.2
Total	10 728	10 269	95.7

* Calculated at peak levels of employment. Does not represent person-years of work.

TOTAL 1985 PETROLEUM EXPENDITURES ON FRONTIER LANDS

	Exploration (\$M)	Development (\$M)	Total (\$M)	Canadian (\$M)	Per cent* Canadian
Mainland Territories (Yukon and NWT)	129.3	58.7	188.0	176.7	94.0
Mackenzie Delta and Beaufort Sea	798.9	0	798.9	639.1	80.0
Arctic Islands and Eastern Arctic Offshore	48.2	7.8	56.0	50.4	90.0
Hudson Bay	37.4	0	37.4	21.7	58.0
Grand Banks and Labrador Sea	657.3	0	657.3	387.8	59.0
Nova Scotia Offshore	481.2	0	481.2	274.3	57.0
Total	2 152.3	66.5	2 218.8	1 550.0	69.9

* Historical estimates.

Nonfuel Minerals

Regional Statistical Summary

COGLA's Ocean Mining Division manages the offshore nonfuel mineral interests on frontier lands that are the administrative responsibility of the Department of Energy, Mines and Resources. COGLA's assessment has indicated that the Canadian offshore is a potential source of a variety of minerals, such as high-purity silica sand and placer gold. Ongoing efforts focus on the development and dissemination of information on offshore nonfuel minerals and in the establishment of an attractive investment climate through implementation of simple, uniform regulations on offshore frontier lands.

In October 1985, the 16th annual meeting of the Underwater Mining Institute was held in Halifax, Nova Scotia. It was the largest meeting in the history of the institute and the first time it was held outside the United States. The conference helped to increase Canadian awareness of offshore mineral potential and demonstrated the applicability of Canadian marine technology to this new field.

Frontier Lands	28
Mainland Territories	
(Yukon and Northwest Territories)	29
Mackenzie Delta and Beaufort Sea	32
Arctic Islands and Eastern Arctic Offshore	35
Hudson Bay	37
Grand Banks and Labrador Sea	39
Nova Scotia Offshore	42



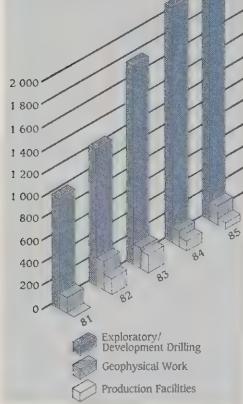
Landing pad, refueling facilities and temporary accommodations on Sable Island contingency base for search and rescue operations on the Scotian Shelf.
Courtesy CCG

Frontier Lands

Statistical Summary

Petroleum Expenditures on Frontier Lands

1981-1985
(million \$)



ACTIVITY STATUS ON FRONTIER LANDS

	1981	1982	1983	1984	1985
Exploration Agreements Concluded	0	47	73	47	5
Wells Spudded	23	56	95	120	99
Metres Drilled	94 364	120 673	187 969	241 298	207 896
Wells Terminated	22	52	90	123	103
Significant Discoveries	7	9	5	11	15
Geophysical Programs Run	70	90	84	65	55
km Shot	84 845	117 803	106 749	63 817	57 091
Rig-Months	97	148	195	236	199

FRONTIER LANDS RESOURCE INVENTORY

	OIL		GAS	
	Discovered (Millions m³)	Potential (Millions m³)	Discovered (Billions m³)	Potential (Billions m³)
West Coast	0	50	0	270
Mainland Territories	51.0	95	21.4	312
Mackenzie Delta and Beaufort Sea	183.1	1 464	284.2	2 151
Arctic Islands and Eastern Arctic Offshore	65.7	873	415.7	3 156
Hudson Bay	0	127	0	88
Grand Banks and Labrador Sea	185.1	1 733	152.4	1 286
Nova Scotia Offshore	20.0	318	127.4	663
Total	504.9	4 660	1 001.1	7 926

OIL AND GAS PRODUCTION ON FRONTIER LANDS

	1981	1982	1983	1984	1985
Oil Production (Thousands m³)					
Norman Wells Oil	173	173	169	175	1 046
Bent Horn Oil	—	—	—	—	30
Gas Production (Millions m³)					
Pointed Mountain Gas	351	206	181	194	219
Norman Wells Gas	47	56	46	41	225

Mainland Territories

Statistical Summary

ACTIVITY STATUS	1981	1982	1983	1984	1985
Wells Spudded					
Exploratory/Delineation	3	0	4	18	15
Development	0	30	57	67	39
Total	3	30	61	85	54
Wells Terminated*					
Exploratory/Delineation	2	1	3	15	17
Development	0	28	57	69	38
Total	2	29	60	84	55
Metres Drilled					
Exploratory/Delineation	4 063	26 457	48 598	80 804	53 924
Development	4 063	2 461	3 608	28 769	23 968
0	23 996	44 990	52 035	29 956	
Geophysical Programs Run	2	8	12	20	17
km Shot	325	3 500	2 720	5 371	5 819

* In the Mainland Territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be reentered in the following year for testing.



RESOURCES STATUS	1981	1982	1983	1984	1985
Discovered Resources* – Update					
Gas (Billions m³)	55.2	55.2	30.5	21.2	21.4
Oil (Millions m³)	40.0	44.5	44.2	52.3	51.0
Gas and Oil Production					
Pointed Mountain Gas (Millions m³)	351	206	181	194	219
Norman Wells Gas (Millions m³)	47	56	46	41	225
Norman Wells Oil (Thousands m³)	173	173	169	175	1 046

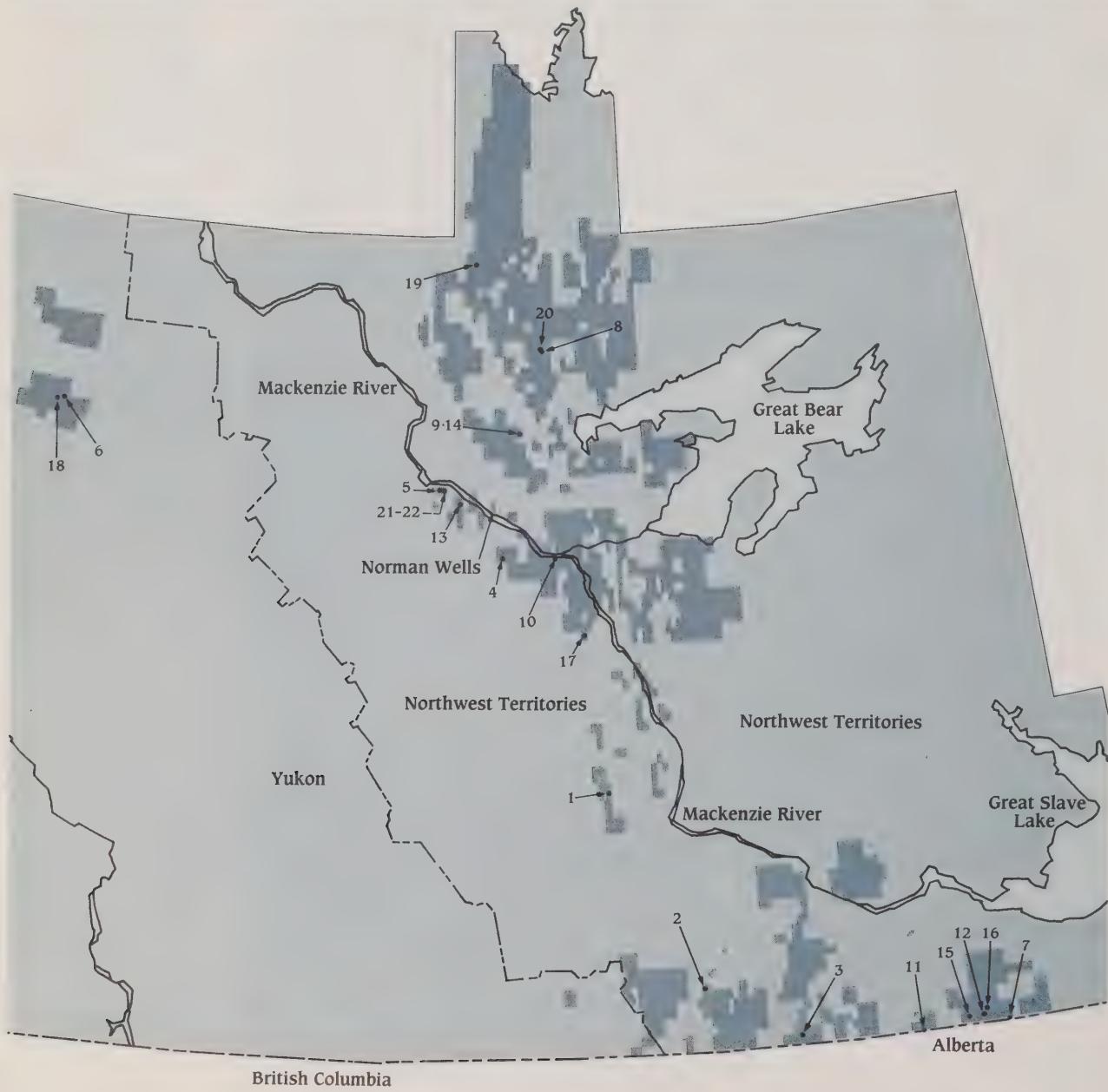
* As reported in previous years.

BENEFITS STATUS	1981	1982	1983	1984	1985
Rigs Active	3	4	5	14	11
Rig-Months	3	31	27	47	31
Money Spent (\$M)					
Geophysical	3.8	31.8	26.3	48.2	60.0
Exploratory/Delineation Drilling	3.4	21.0	12.5	49.5	69.3
Development Drilling	0	31.0	24.9	72.1	35.2
Production Facilities	0	133.7	159.8	86.1	23.5
Total	7.2	217.5	223.5	255.9	188.0

LAND STATUS	1981	1982	1983	1984	1985
Exploration Agreements (EAs) Concluded	0	0	27	7	0
Total EAs Active	0	0	27	34	34
Lands Negotiated into EAs (Millions of Hectares)	0	0	7.4	1.4	0
Lands Relinquished/Surrendered	N/A	N/A	N/A	0.1	3.1
Lands Active	21.0	18.2	13.7	12.3	9.2

Mainland Territories

Statistical Summary



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1	Forward et al Dahadinni J-66	62°35'44" N 124°41'57" W	Mr. Gary	84-02-12 84-03-11	Plugged & abandoned	1850
			Mr. Gary	85-02-05 85-03-01		
2	NSM Arrowhead G-69	60°38'24" N 122°57'02" W	Regent 2	84-02-13 84-03-30	Plugged & suspended, gas discovery	2500
			Roll 'n Rig 10	85-01-06 85-01-23		
3	Northcor et al Island River G-38	60°07'29" N 121°06'10" W	Guthrie MacLaren 5	84-02-14 84-04-01	Plugged & abandoned	2446
			Roll 'n Rig 53	85-02-20 85-03-13		
4	NSM Mirror Lake N-33	64°52'46" N 126°51'52" W	Peter Bawden 1	84-03-06 84-04-07	Plugged & abandoned	2026
			Roll 'n Rig 53	85-01-02 85-01-13		
5	AT&S Carcajou D-05	65°34'13" N 128°16'43" W	Kenting 33	84-12-19 85-01-22	Plugged & suspended	755
			Beta 60	85-02-07 85-02-24		
6	Exco et al West Parkin Y.T. D-54	66°13'10" N 137°26'10" W	Custom Drilling 94	84-12-20 85-02-19	Plugged & suspended	1811
7	Exco et al Cameron River L-11	60°00'38" N 117°03'28" W	Arnco 1	84-12-23 85-01-17	Plugged & abandoned	1105
8	PCI et al Tweed Lake M-47	66°56'47" N 125°54'09" W	Atco/Equitak 76	85-01-11 85-02-24	Plugged & suspended, gas discovery	1420
9	Exco et al Tunago N-37	66°06'50" N 126°22'00" W	Mr. Ben	85-01-12 85-01-31	Junked & abandoned	319
10	NSM Windy Island A-53	64°52'01" N 125°39'37" W	Peter Bawden 1	85-01-16 85-02-10	Plugged & abandoned	1500
11	Home Silt Lake South G-21	60°00'25" N 118°49'22" W	Hi Tower 17	85-01-19 85-02-26	Plugged & abandoned	1846
12	Exco et al Cameron I-16	60°05'43" N 117°32'02" W	Arnco 1	85-01-21 85-02-16	Plugged & suspended, gas discovery	1490
13	AT&S Hoosier F-27	65°26'16" N 127°49'59" W	Kenting 33	85-01-28 85-03-01	Plugged & abandoned	1321
14	Exco et al Tunago 2N-37	66°06'50" N 126°22'00" W	Mr. Ben	85-02-04 85-03-16	Plugged & abandoned	1626
15	Northcor et al Kakisa River F-56	60°05'27" N 117°55'28" W	Badger 2	85-02-17 85-03-21	Plugged & abandoned	1711
16	Exco et al Cameron Hills I-10	60°09'39" N 117°30'04" W	Arnco 1	85-02-19 85-04-02	Plugged & suspended	1613
17	Esso AT&S et al Keele South E-19	64°08'24" N 125°03'42" W	Peter Bawden 1	85-02-21 85-03-31	Plugged & suspended	2450
18	Exco et al North Chance Y.T. D-22	66°11'06" N 137°35'33" W	Custom Drilling 94	85-03-01 85-04-08	Plugged & abandoned	1830
19	PCI Westcoast et al K'ahbami H-56	67°45'27" N 127°24'49" W	Atco/Equitak 76	85-03-05 85-04-07	Plugged & abandoned	1605
20	PCI Canterra Tweed Lake A-67 (Tweed Lake delineation)	66°56'12" N 125°56'19" W	Atco/Equitak 76	85-11-13 85-12-23	Plugged & suspended	1347
21	AT&S Texaco Maida Creek 0-65	65°34'53" N 128°11'47" W	Jade 5	85-12-15 85-12-21	Junked & abandoned	191
22	AT&S Texaco Maida Creek 20-65	65°34'53" N 128°11'47" W	Jade 5	85-12-24	Drilling	547

Mackenzie Delta and Beaufort Sea

Statistical Summary



ACTIVITY STATUS	1981	1982	1983	1984	1985
Wells Spudded Exploratory/Delineation	4	8	11	6	19
Wells Terminated* Exploratory/Delineation	6	8	4	12	16
Metres Drilled Exploratory/Delineation	29 055	23 580	37 381	31 682	48 370
Geophysical Programs Run	11	10	9	13	8
Km Shot	13 052	6 355	7 684	7 959	4 700

RESOURCES STATUS	1981	1982	1983	1984	1985
Discovered Resources* – Update Gas (Billions m³)	246.5	254.8	286.5	279.5	284.2
Oil (Millions m³)	93.2	111.3	133.0	130.4	183.1

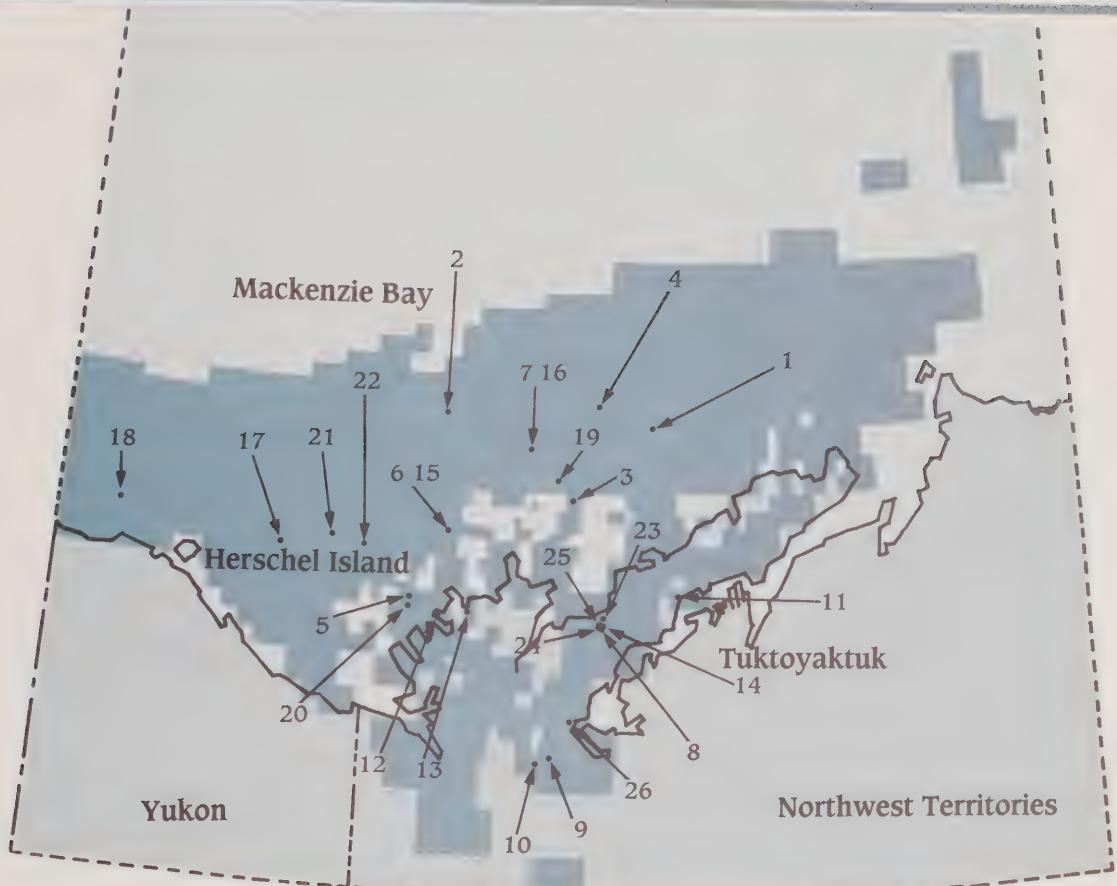
BENEFITS STATUS	1981	1982	1983	1984	1985
Rigs Active	6	8	9	11	13*
Rig-Months	24	28	31	39	43
Money Spent (\$M)					
Geophysical Exploratory/Delineation Drilling	20.8 540.0	18.3 600.0	28.1 629.8	27.2 786.4	38.4 760.5
Total	560.8	618.3	657.9	813.6	798.9

LAND STATUS	1981	1982	1983	1984	1985
Exploration Agreements (EAs) Concluded	0	6	9	9	0
Total EAs Active	0	6	15	24	23
Lands Negotiated into EAs (Millions of Hectares)	0	2.3	6.8	1.8	0
Lands Relinquished/Surrendered	N/A	N/A	N/A	0.3	1.6
Lands Active	14.9	11.6	9.2	8.9	7.3

* In the Beaufort Sea, where operations from floating vessels are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

* As reported in previous years.

* Two rigs worked both in the Mainland Territories and in the Mackenzie Delta in 1985.



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1	Dome et al Havik B-41	70°20'11" N 132°13'05" W	<i>Explorer III</i>	83-07-17 83-07-29		
			<i>Explorer II</i>	83-09-13 83-09-29		
			<i>Explorer II</i>	84-06-29 84-10-06		
			<i>Explorer I</i>	85-08-22 85-09-30	Plugged & suspended	4750
2	Dome et al Arluk E-90	70°19'24" N 135°26'35" W	<i>Explorer III</i>	83-07-30 83-09-19		
			<i>Explorer III</i>	84-07-31 84-10-22		
			<i>Explorer IV</i>	85-09-24 85-10-13	Plugged & abandoned	4300

Mackenzie Delta and Beaufort Sea

Statistical Summary

Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
3	Esso Home et al Amerk 0-09	69°58'56" N 133°30'53" W	SCRI Esso Rig 7	84-08-22 85-03-03	Plugged & abandoned, gas discovery	5000
4	Dome et al Nerlerk J-67 (Nerlerk delineation)	70°26'42" N 133°19'29" W	Kulluk	84-09-26 84-10-15		
			Kulluk	85-08-17 85-10-23	Plugged & abandoned	4904
5	Esso Trillium Adgo H-29 (Adgo delineation)	69°28'23" N 135°50'21" W	Kenting 32	84-09-27 85-01-12	Plugged & abandoned, gas	3314
6	Esso PCI Home et al Nipterk L-19	69°48'38" N 135°19'53" W	Esso Rig 3	84-10-03 85-03-23	Plugged & abandoned, oil and gas discovery	3879
7	Gulf et al Akpak P-35	70°14'52" N 134°09'24" W	Kulluk	84-10-17 84-11-08		
			Kulluk	85-06-10 85-07-07	Junked & abandoned	2169
8	Esso PCI Home et al Tuk J-29 (Tuk Cretaceous delineation)	69°18'43" N 135°05'51" W	Esso Rig 2	85-01-10 85-04-20	Plugged & abandoned, oil and gas discovery	3176
9	Gulf et al Onigat D-52	68°41'01" N 133°44'24" W	Spartan 20	85-01-23 85-02-12	Plugged & abandoned	1409
10	Gulf et al Shakgatlatachig D-50	68°39'07" N 133°57'08" W	Spartan 20	85-02-21 85-03-22	Plugged & abandoned	2061
11	Esso PCI Home et al Itkrilek B-52	69°31'14" N 131°58'32" W	Kenting 33	85-03-21 85-04-04	Plugged & abandoned	1284
12	Chevron Trillium Upluk L-42	69°21'38" N 135°27'29" W	Spartan 10	85-03-22 85-05-08		
			Spartan 10	85-06-29 85-07-19	Plugged & suspended	3350
13	Esso Home et al Taglu West H-06	69°25'22" N 135°00'28" W	Kenting 32	85-03-26 85-09-05	Plugged & abandoned	4200
14	Esso PCI Home et al Tuk H-30 (Tuk Tertiary delineation)	69°19'21" N 133°05'14" W	Kenting 33	85-04-21 85-05-06		
			Roll'n Rig 12	85-11-24 85-12-28	Plugged & abandoned	1399
15	Esso PCI Home et al Nipterk L-19A (Nipterk delineation)	69°48'38" N 135°19'53" W	Esso Rig 3	85-04-21 85-07-21	Plugged & abandoned, oil and gas	3520
16	Gulf et al Akpak 2P-35	70°14'52" N 134°09'23" W	Kulluk	85-07-08 85-08-14	Plugged & abandoned	3673
17	Dome et al Adlartok P-09	69°38'52" N 137°45'28" W	Explorer III	85-08-08 85-10-17	Plugged & abandoned, oil discovery	2647
18	Dome et al Edlok N-56	69°45'50" N 140°14'22" W	Explorer IV	85-08-10 85-09-16	Plugged & abandoned	2530
19	Gulf et al Amauligak 1-65 (Amauligak delineation)	70°04'40" N 133°48'16" W	Molikpaq	85-09-24	Testing	4126
20	Esso Trillium et al Adgo G-24 (Adgo delineation)	69°23'29" N 135°50'50" W	Kenting 32	85-10-07	Testing	3087
21	Gulf et al Agnerk E-56	69°45'16" N 136°59'56" W	Kulluk	85-10-28 85-11-10	Plugged & suspended	875
22	Esso PCI Home et al Minuk I-53	69°42'35" N 136°27'32" W	Esso Rig 3	85-11-27	Drilling	1718
23	Esso PCI Home et al Tuktuk A-12 (Tuk Tertiary delineation)	69°21'00" N 133°03'00" W	Esso Rig 2	85-12-02	Drilling	1790
24	Esso PCI Home et al Tuk G-39 (Tuk Tertiary delineation)	69°18'23" N 133°08'43" W	Kenting 33	85-12-05	Drilling	1797
25	Esso PCI Home et al Tuk B-40 (Tuk Tertiary delineation)	69°19'14" N 133°08'20" W	Spartan 20	85-12-09	Drilling	1590
26	Gulf et al Parsons F-02	68°51'21" N 133°31'50" W	Peter Bawden 1	85-12-22	Drilling	505

Arctic Islands and Eastern Arctic Offshore

Statistical Summary

ACTIVITY STATUS	1981	1982	1983	1984	1985
Wells Spudded Exploratory/Delineation	6	7	4	3	3
Wells Terminated Exploratory/Delineation	5	6	5	4	3
Metres Drilled Exploratory/Delineation	14 712	18 987	12 087	11 007	6 185
Geophysical Programs Run	7	6	2	1	0
km Shot	2 425	5 126	1 142	601	0
RESOURCES STATUS	1981	1982	1983	1984	1985
Discovered Resources* — Update Gas (Billions m³)	326.5	379.5	372.2	390.1	415.7
Oil (Millions m³)	42.0	47.7	76.1	49.3	65.7
Gas and Oil Production					
Bent Horn Oil (Thousands m³)	N/A	N/A	N/A	N/A	30

* As reported in previous years.

BENEFITS STATUS	1981	1982	1983	1984	1985
Rigs Active	3	6	4	4	3
Rig-Months	15	19	17	13	9
Money Spent (\$M)					
Geophysical Exploratory/Delineation Drilling	9.1	15.6	6.2	4.6	0.2
Production Facilities	59.5	122.5	67.8	64.0	48.0
Total	0	0	0	0	7.8
	68.6	138.1	74.0	68.6	56.0
LAND STATUS	1981	1982	1983	1984	1985
Exploration Agreements (EAs) Concluded	0	21	0	3	1
Total EAs Active	0	21	21	24	25
Lands Negotiated into EAs (Millions of Hectares)	0	24.5	0	1.5	0.7
Lands Relinquished/Surrendered	N/A	N/A	N/A	0.9	1.4
Lands Active	33.1	24.5	17.3	15.8	15.1



Arctic Islands and Eastern Arctic Offshore

Statistical Summary



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1	Panarctic et al Cape Allison C-47	77°46'05" N 100°17'21" W	Panarctic Rig A	85-01-31 85-05-08	Plugged & abandoned, oil and gas discovery	2100
2	Panarctic et al East Drake L-06	76°25'35" N 107°33'18" W	Panarctic Rig B	85-02-15 85-04-16	Plugged & abandoned, gas discovery	1300
3	Panarctic et al Skybattle Bay M-11	77°10'56" N 105°06'44" W	Panarctic Rig C	85-10-17 85-12-30	Plugged & abandoned	2785



Hudson Bay

Statistical Summary



ACTIVITY STATUS	1981	1982	1983	1984	1985
Wells Spudded Exploratory/Delineation	0	0	0	0	2
Wells Terminated Exploratory/Delineation	0	0	0	0	2
Metres Drilled Exploratory/Delineation	0	0	0	0	3 255
Geophysical Programs Run	0	1	2	2	0
km Shot	0	5 488	8 447	491	0
RESOURCES STATUS	1981	1982	1983	1984	1985
Discovered Resources* – Update Gas (Billions m³)	0	0	0	0	0
Oil (Millions m³)	0	0	0	0	0
* As reported in previous years.					
BENEFITS STATUS	1981	1982	1983	1984	1985
Rigs Active	0	0	0	0	1
Rig-Months	0	0	0	0	3
Money Spent (\$M) Geophysical Exploratory/Delineation Drilling	0	6.5	7.0	1.1	0
Total	0	6.5	7.0	1.1	37.4
LAND STATUS	1981	1982	1983	1984	1985
Exploration Agreements (EAs) Concluded	0	0	0	0	2
Total EAs Active	0	0	0	0	2
Lands Negotiated into EAs (Millions of Hectares)	0	0	0	0	23.3
Lands Relinquished/Surrendered	N/A	N/A	N/A	6.3	0.2
Lands Active	30.6	30.6	30.6	24.2	23.1

Hudson Bay

Statistical Summary



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1	Trillium Soquip Onexco et al Beluga O-23	59°12'54" N 88°33'27" W	Neddrill 2	85-07-28 85-09-15	Plugged & abandoned	2215
2	ICG Sogepet et al Netsiq N-01	59°50'48" N 87°31'00" W	Neddrill 2	85-09-15 85-10-20	Plugged & abandoned	1040

Grand Banks and Labrador Sea

Statistical Summary

ACTIVITY STATUS	1981	1982	1983	1984	1985
Wells Spudded Exploratory/Delineation	8	5	7	12	11
Wells Terminated Exploratory/Delineation	8	4	10	10	13
Metres Drilled Exploratory/Delineation	38 540	23 105	29 815	46 759	49 098
Geophysical Programs Run	34	33	21	12	16
km Shot	41 874	61 411	48 261	27 808	19 758
RESOURCES STATUS	1981	1982	1983	1984	1985
Discovered Resources* – Update Gas (Billions m ³)	124.0	124.0	126.7	145.2	152.4
Oil (Millions m ³)	230.5	257.5	211.5	159.9	185.1

* As reported in previous years.

BENEFITS STATUS	1981	1982	1983	1984	1985
Rigs Active	6	7	9	9	8*
Rig-Months	42	31	48	54	63
Money Spent (\$M)					
Geophysical Exploratory/Delineation Drilling	43.8 308.0	71.6 210.0	57.4 436.9	27.8 485.9	27.3 630.0
Total	351.8	281.6	494.3	513.7	657.3

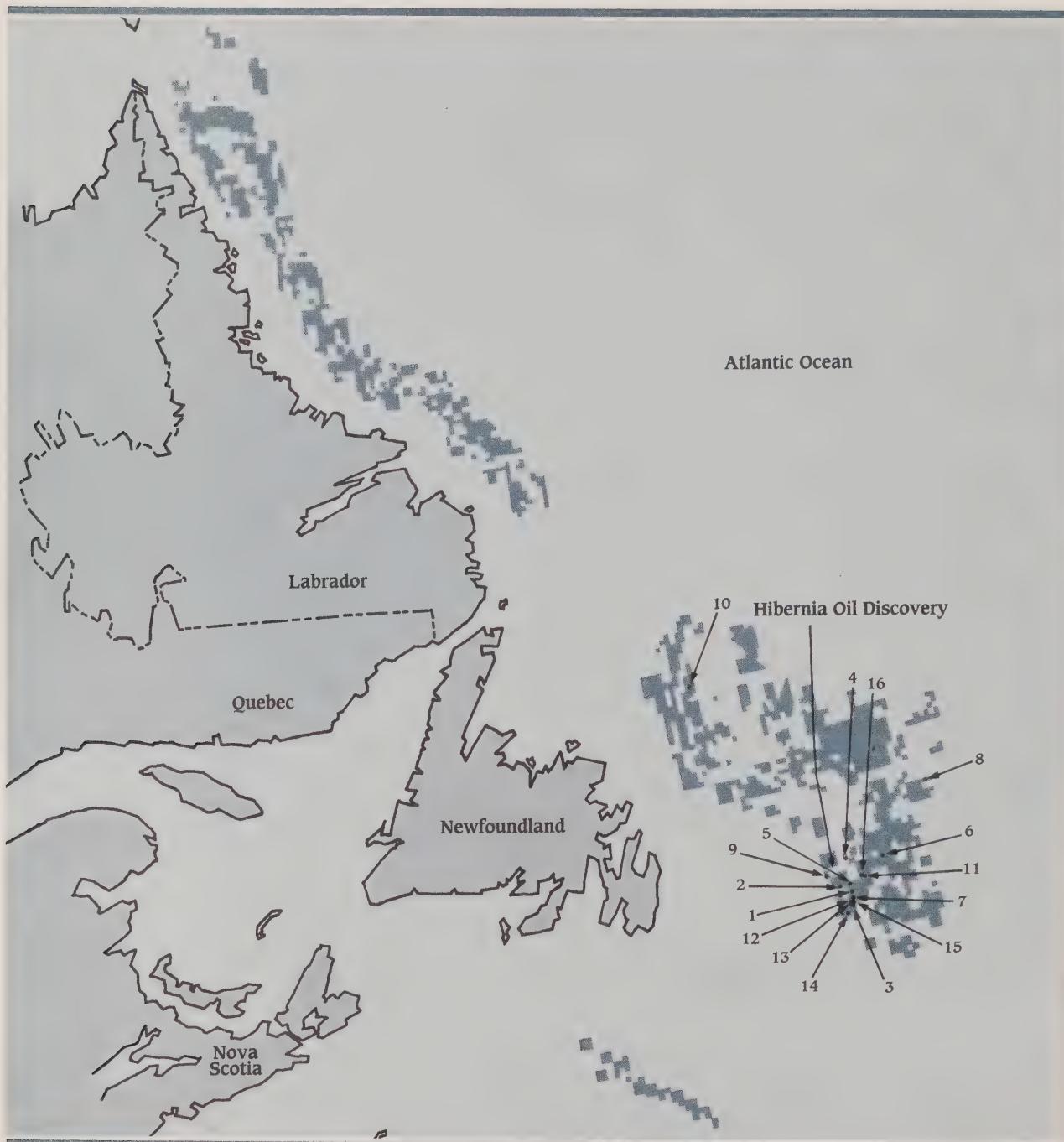
* Three rigs worked off both Nova Scotia and Newfoundland in 1985.

LAND STATUS	1981	1982	1983	1984	1985
Exploration Agreements (EAs) Concluded	0	0	32	13	0
Total EAs Active	0	0	32	41	38
Lands Negotiated into EAs (Millions of Hectares)	0	0	10.3	6.0	0
Lands Relinquished/Surrendered	N/A	N/A	N/A	8.6	10.9
Lands Active	29.1	29.1	24.6	22.0	11.9



Grand Banks and Labrador Sea

Statistical Summary



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1	Petro-Canada et al West Ben Nevis B-75	46°35'01" N 48°26'04" W	Bow Drill I	84-07-15 85-04-03	Plugged & abandoned, oil discovery	4987
			Sedco 710	85-04-27 85-07-18		
2	Mobil et al Mara M-54	46°43'48" N 48°38'45" W	John Shaw	84-10-21 85-05-14	Plugged & abandoned, oil discovery	4446
3	Canterra PCI et al Beothuk M-05	46°24'49" N 48°31'14" W	Vinland	84-11-05 85-01-25	Plugged & abandoned, oil	3779
4	HBV et al Conquest K-09	47°08'35" N 48°15'45" W	Bow Drill II	84-11-13 85-07-26	Plugged & abandoned	4968
5	HBV et al North Ben Nevis P-93	46°42'48" N 48°28'34" W	Bow Drill III	84-12-18 85-11-01	Plugged & abandoned, oil and gas discovery	5282
6	HBV et al Panther P-52	47°01'53" N 47°37'44" W	Sedco 706	85-01-10 85-01-22	Drilling	3650
			Bow Drill III	85-11-06		
7	Petro-Canada et al North Trinity H-71 (Hebron delineation)	46°30'24" N 48°25'36" W	Vinland	85-01-27 85-09-02	Plugged & abandoned	4758
8	Esso Parex et al Baccalieu I-78	47°57'42" N 46°10'51" W	Sedco 709	85-05-15 85-09-14	Plugged & abandoned	5135
9	Mobil et al Mercury K-76	46°55'35" N 48°56'34" W	John Shaw	85-05-19 85-09-15	Plugged & abandoned	5213
10	BP et al Baie Verte J-57	50°16'44" N 51°07'54" W	Bow Drill I	85-07-10 85-10-16	Plugged & abandoned	4911
11	HBV et al Whiterose J-49 (Whiterose delineation)	46°48'31" N 48°06'27" W	Bow Drill II	85-07-27 85-12-11	Plugged & abandoned, oil and gas	4561
12	Petro-Canada et al Terra Nova K-07 (Terra Nova delineation)	46°26'44" N 48°30'58" W	Vinland	85-09-05 85-11-21	Plugged & suspended, oil	3550
13	Canterra PCI et al Terra Nova K-17	46°26'44" N 48°32'32" W	Sedco 710	85-09-25 85-11-14	Plugged & abandoned	3250
14	Petro-Canada et al Gumbo N-70	46°19'52" N 48°39'55" W	Sedco 710	85-11-16 85-12-28	Plugged & abandoned	2515
15	Petro-Canada et al Terra Nova I-97 (Terra Nova delineation)	46°26'44" N 48°28'49" W	Vinland	85-11-26	Drilling	2452
16	HBV et al Whiterose L-61 (Whiterose delineation)	46°50'35" N 48°10'28" W	Bow Drill II	85-12-18	Drilling	1677

In 1985, abandonment operations were completed for the following wells which had been suspended or abandoned in previous years.

Mobil et al Sheridan J-87	Mobil et al Hibernia K-14
Mobil et al North Dana I-43	Mobil et al Hebron I-13
Mobil et al Hibernia B-08	Mobil et al Hibernia J-34
Mobil et al Hibernia B-27	Mobil et al Hibernia K-18
Mobil et al Hibernia C-96	Mobil et al Hibernia O-35
Chevron et al Hibernia P-15	Mobil et al Nautilus C-92
Petro-Canada et al Pining E-16	Mobil et al Ben Nevis I-45
HBV et al Archer K-19	

Nova Scotia Offshore (includes the Gulf of St. Lawrence)

Statistical Summary



ACTIVITY STATUS	1981	1982	1983	1984	1985
Wells Spudded Exploratory/Delineation	2	6	12	14	10
Wells Terminated Exploratory/Delineation	1	5	11	13	14
Metres Drilled Exploratory/Delineation	7 994	28 544	60 088	71 046	47 064
Geophysical Programs Run	16	32	38	17	14
km Shot	27 169	35 923	38 495	21 587	26 814
RESOURCES STATUS	1981	1982	1983	1984	1985
Discovered Resources* – Update Gas (Billions m³)	60.4	79.3	108.7	122.6	127.4
Oil (Millions m³)	8.2	8.2	13.7	16.7	20.0
<i>* As reported in previous years.</i>					
BENEFITS STATUS	1981	1982	1983	1984	1985
Rigs Active	2	6	9	10	8*
Rig-Months	13	39	72	83	50
Money Spent (\$M)					
Geophysical Exploratory/Delineation Drilling	25.2 65.0	43.8 220.0	50.5 579.4	23.2 594.7	29.2 452.0
Total	90.2	263.8	629.9	617.9	481.2
<i>* Three rigs worked off both Nova Scotia and Newfoundland in 1985.</i>					
LAND STATUS	1981	1982	1983	1984	1985
Exploration Agreements (EAs) Concluded	0	20	5	15	2
Total EAs Active	0	20	25	30	28
Lands Negotiated into EAs (Millions of Hectares)	0	9.0	0.5	10.5	0.9
Lands Relinquished/Surrendered	N/A	N/A	1.6	8.5	2.8
Lands Active	20.2	20.2	20.0	6.3	4.2



Nova Scotia Offshore (includes the Gulf of St. Lawrence) Statistical Summary

Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1	Mobil et al West Venture N-91	44°00'46" N 59°44'27" W	Zapata Scotian	84-04-19 85-07-04	Plugged & abandoned, gas discovery	5547
2	Mobil et al West Venture C-62	44°01'03" N 59°40'01" W	Rowan Juneau	84-05-19 85-03-14	Plugged & abandoned, gas discovery	5522
3	BUH et al Hesper P-52	44°41'51" N 57°52'48" W	Rowan Gorilla I	84-08-31 85-05-02	Plugged & abandoned	5679
4	Shell PCI et al Glenelg H-38 (Glenelg delineation)	43°37'19" N 60°04'49" W	Sedco 709	84-10-26 85-01-26	Plugged & abandoned	4865
5	Petro-Canada Texaco et al Albatross B-13	42°42'11" N 63°02'12" W	Sedco 710	84-12-13 85-03-28	Plugged & abandoned	4046
6	Home et al Citadel H-52	44°11'25" N 58°52'40" W	Glomar Labrador I	84-12-18 85-05-29	Plugged & abandoned	5666
7	Mobil et al West Venture N-01 (relief well)	44°00'59" N 59°45'52" W	Rowan Gorilla III	85-01-20 85-06-29	Plugged & abandoned	3632
8	Shell PCI et al Alma K-85 (Alma delineation)	43°34'44" N 60°43'02" W	Sedco 709	85-01-29 85-04-10	Plugged & abandoned, gas	3602
9	Mobil et al Thebaud I-93 (Thebaud delineation)	43°52'44" N 60°13'51" W	Rowan Juneau	85-03-27 85-09-27	Plugged & abandoned, gas	5166
10	Petro-Canada et al Shelburne G-29	42°38'27" N 63°33'33" W	Sedco 710	85-03-31 85-04-06	Plugged & abandoned	4005
			Sedco 710	85-08-07 85-09-16		
11	Shell PCI et al Peskowesk A-99	44°28'14" N 58°58'41" W	Sedco 706	85-04-22 85-06-13	Plugged & abandoned	4003
12	Shell PCI et al Kegesheek G-67	44°06'29" N 60°24'31" W	Glomar Labrador I	85-06-11 85-07-29	Plugged & abandoned	3540
13	Shell PCI et al Merigomish C-52	43°31'03" N 60°38'34" W	Sedco 706	85-06-15 85-08-12	Plugged & abandoned	3950
14	Mobil et al West Olympia O-51	44°00'48" N 59°53'04" W	Rowan Gorilla I	85-06-23 85-11-09	Plugged & abandoned, gas discovery	4816
15	Shell PCI et al North Triumph G-43	43°42'19" N 59°51'23" W	Sedco 709	85-09-26	Drilling	4319
16	Petro-Canada et al Cohasset A-52 (Cohasset delineation)	43°51'08" N 60°37'44" W	Rowan Gorilla I	85-12-20	Drilling	854



Glossary of Terms

Abandoned Well: any well that has been permanently plugged.

Call for Bids: a notice published in the *Canada Gazette* or other publication, whereby the minister calls for the submission of bids in relation to Crown reserve land (formerly referred to as Call for Proposals).

Call for Nominations: a notice inviting interested parties to nominate tracts of lands for potential inclusion in a Call for Bids.

Commercial Discovery: an oil or gas discovery that justifies the investment of capital and effort to bring it into production.

Completed Well: a well that has been drilled and equipped so that it is capable of producing oil or gas.

Condensate: hydrocarbons occurring in gaseous form at subsurface temperatures and pressures, but which condense to the liquid state at surface temperature and pressure.

Cubic Metre of Gas: equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.

Cubic Metre of Oil: equivalent to 6.2898 American stock tank barrels.

Delineation Well: a well drilled as a follow-up, offset, step-out or extension to a significant discovery on the same geological feature, the purpose of which is to determine the extent and commercial potential of the oil or gas accumulation encountered in the discovery well.

Development Plan: a plan describing the wells and other facilities proposed to develop a field.

Development Well: a well drilled as part of a development plan.

Drillship: a ship-shaped mobile offshore drilling unit (MODU), specially constructed or converted for drilling for oil and gas.

Dry Hole: a well that has failed to encounter oil or gas in significant amounts.

Dynamic Positioning: the technique of maintaining a vessel over a well by means of on-board propulsion units.

Exploration Licence: a licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a Production Licence subject to compliance with the other provisions of the Canada Petroleum Resources Act (formerly Exploration Agreement).

Exploratory Well: a well drilled on a geological feature on which a significant discovery has not previously been made (synonymous with wildcat well).

Gravity-Fed Loading Line: a pipeline that uses elevation differences (i.e., gravity) to cause liquid to flow freely from the storage area to a transport vessel.

Heater Glycol Facility: a facility that heats a mixture of water and glycol, which is then used to heat the oil in the storage tank.

Hectare: one hectare equals 2.47 acres or 10 000 square metres.

Hydrocarbon: a naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.

Hypothermia: a condition whereby body temperature is below normal, most frequently caused by exposure to low ambient temperatures.

Ice Platform: a specially thickened platform made of ice which supports a conventional land drilling rig thereby enabling a well to be drilled in deep water between Arctic land masses.

Jack-up: a drilling unit that is elevated above sea level after arrival on a wellsite by setting supporting piles (legs) into the seabed and elevating the drill floor (hull) on a system of jacks.

MODU (mobile offshore drilling unit): any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.

Relief Well: a well drilled to assist in controlling a blowout in an existing well.

Sacrificial Beach Island: an island made of sand by dredging or other means, and which has long, sloping beaches to combat erosion by waves.

Semisubmersible: a MODU which is stabilized by ballasting its pontoons (base) and columns to a predetermined depth during drilling operations. Used extensively in rough seas.

Separating Facility: an array of pressure vessels that separate the crude effluent from an oil well into its components of natural oil, gas and water.

Snubbing Unit: an assembly composed of blowout preventors and a hydraulic jack used to force drillpipe and other tools into a well against pressure.

Steel Caisson Retained Island: a drilling platform presently in use in the Beaufort Sea, consisting of eight reusable caisson segments, filled with sand and arranged as an octagon, thus providing an island surface for the drilling rig.

Suspended Well: a well in which drilling or production operations have temporarily ceased.

Terminated Well: a well that has reached total depth and has been abandoned, completed or suspended.

COGLA Offices

	Mailing Address	Street Address	Telephone	Telex	Telecopier
Headquarters	15th Floor, Tower B, 355 River Road, Vanier, Ontario K1A 0E4	14th Floor, Tower B, 355 River Road, Vanier, Ontario	(613) 993-3760	053-4366	993-9897
Maritimes	2000 Barrington Street, Suite 102, Halifax, Nova Scotia, B3J 3K1	Cogswell Tower, Scotia Square, 2000 Barrington Street, Halifax, Nova Scotia	(902) 426-8570	019-23632	426-5253
	COGLA Laboratory, P.O. Box 1006, Dartmouth, Nova Scotia, B2Y 4A2	Bedford Institute of Oceanography, Dartmouth, Nova Scotia	(902) 426-3179 or (902) 426-2525		
Northwest Territories	P.O. Box 1500, Yellowknife, N.W.T., X1A 2R3	Bellanca Building, 4914-50th Street, 6th Floor, Yellowknife, N.W.T.	(403) 920-8175	034-45570	873-8707
	P.O. Box 2020, Inuvik, N.W.T., XOE OTO		(403) 979-3006	034-44541	979-2090
Western	P.O. Box 2638, Station M, Calgary, Alberta, T2P 3C1	Room 482, 220-4th Avenue SE, Calgary, Alberta	(403) 231-5631		

Canada



Energy, Mines and
Resources Canada
Indian and Northern
Affairs Canada

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Ressources Canada
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et du Nord Canada

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The Canada
Oil and
Gas Lands
Administration

Annual
Report
1986

Corporate Profile

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a Memorandum of Understanding between the ministers of Energy, Mines and Resources and Indian Affairs and Northern Development.

COGLA is the federal government's principal contact with the oil and gas industry for the regulation of oil and gas activity on Canada's frontier lands. These lands include the Yukon Territory, the Northwest Territories, Hudson Bay and most of the country's offshore areas. The Canada-Newfoundland Offshore Petroleum Board has had operational responsibilities for the Newfoundland and Labrador offshore since January 1986. A new Canada-Nova Scotia Offshore Oil and Gas Board, with operational responsibilities in the Nova Scotia offshore, will be established in the near future as a result of the 1986 Canada - Nova Scotia Offshore Petroleum Resources Accord.

COGLA's prime responsibility is to regulate the exploration for and the development and production of oil and gas on Canada's frontier lands in a manner that ensures safety of the worker, effec-

tive resource conservation, protection of the environment and full and fair access by Canadians to the benefits arising from the development of hydrocarbon resources.

COGLA has five branches:

- The Rights Management Branch
- The Engineering Branch
- The Resource Evaluation Branch
- The Environmental Protection Branch
- The Policy Analysis and Coordination Branch

COGLA's regional offices in Halifax and Yellowknife have operational responsibility for the Nova Scotia offshore and the North, respectively. These offices issue authorizations to drill wells and also conduct regular inspections and monitor the engineering, geological, environmental and Canada benefits aspects of all oil and gas industry operations. The Halifax office also approves geophysical and geological programs.



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Message from the Minister of Energy, Mines and Resources, the Honourable Marcel Masse



Minister Marcel Masse

I have the great honour to submit to Parliament the fifth annual report of the Canada Oil and Gas Lands Administration (COGLA). This organization, created in 1981, regulates oil and gas exploration, development and production on frontier lands. It does this in a way that conserves resources while respecting the environment and allowing Canadians to benefit from the socio-economic spin-offs generated by oil and gas activity.

In 1986 COGLA played an important role in the development of Bill C-5, the Canada Petroleum Resources Act, and Bill C-6, the Canada-Newfoundland Accord Implementation Act. These two bills are intended to create a stable regime favorable to industrial investment, and also to improve relations between the federal and provincial governments in the management of hydrocarbon resources on frontier lands.

Through a series of measures, Bill C-5 will reduce government intervention which was so dominant under the framework of the National Energy Program. This reduction in government intervention will support industry by encouraging its spirit of initiative, and thus allow Canada to respond better to global market fluctuations and to meet the challenge of energy self-sufficiency.

The close cooperation of the provinces is essential if Canada's energy opportunities are to be realized. With this in mind, the government prepared Bill C-6, which translates the Atlantic Accord into law. This bill is a binding commitment to bilateral cooperation and is essentially based on joint management and revenue sharing. Moreover, the Canada-Newfoundland Offshore Petroleum Board, an independent body, will ensure that both levels of government participate in decisions relating to the management of oil and gas resources offshore.

These bills have also taken into account the concerns of native populations and the protection of the environment. A research fund has been created to finance the study of the relationship between the environment and exploration, development and production activities on frontier lands. The fund will be managed by a group of experts, including a representative of the public.

Bills C-5 and C-6 were drawn up after much consultation and they have received enthusiastic support from the Canadian oil and gas industry and the governments of Newfoundland, Nova Scotia, the Yukon Territory and the Northwest Territories.

In Halifax last August, the Prime Minister of Canada, Mr. Brian Mulroney, and the Premier of Nova Scotia, Mr. John Buchanan, signed the

Canada - Nova Scotia Offshore Petroleum Resources Accord. This long-term agreement provides for joint management of offshore oil and gas exploration and development. This accord replaces the 1982 Canada - Nova Scotia Offshore Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing. It includes several significant improvements, notably the creation of an independent body, the Canada - Nova Scotia Offshore Oil and Gas Board, to administer and regulate all oil and gas activity offshore Nova Scotia, and a change in the development fund from a loan to a grant. In addition, Nova Scotia Resources Limited will receive a grant for drilling. The new accord provides for revenue sharing by the two levels of government on the same basis as if those resources were on land.

In 1986 the Crown granted rights in the Newfoundland and Nova Scotia offshore for oil and gas exploration. In February the Canada-Newfoundland Offshore Petroleum Board announced the awarding of exploration rights for three of six parcels of land to three companies in the Newfoundland offshore.

In November the Canada - Nova Scotia Offshore Petroleum Board announced the awarding of exploration rights on a block of land to a group of companies represented by Petro-Canada.

The month of June marked an important step in the development of a major project. The Canada-Newfoundland Offshore Petroleum Board made public its decision report on the Hibernia project, based on the plans for development and economic spin-offs which had been submitted by the companies involved. The board's decision provides Mobil and its associates with the regulatory approvals to enable them to develop one of the most important oil deposits in the world, the Hibernia field in the Grand Banks. The development of such an oil and gas deposit will undoubtedly bring jobs and other related economic benefits to Newfoundlanders and all Canadians.

The willingness of various levels of government to work together to manage our oil and gas resources on the frontier lands is in everyone's interest. Industry will improve the resource capital, create jobs and stimulate economic growth. The federal-provincial spirit of cooperation that characterized 1986 can only improve and enhance our efforts to reach the goal so important to us all: the development of our energy resources.

A handwritten signature in black ink, appearing to read "Marcel Masse".

Message from the Minister of Indian Affairs and Northern Development, the Honourable Bill McKnight

I am pleased to join my colleague, the Minister of Energy, Mines and Resources, Marcel Masse, in submitting to Parliament the *1986 Annual Report of the Canada Oil and Gas Lands Administration*.

The development of Canada's northern oil and gas resources is a vital factor in maintaining the economic well-being of Northerners and enhancing Arctic sovereignty. Indeed, how we pursue the important oil and gas potential of our northern regions bears significantly on the economic prosperity of the entire country.

In the Yukon Territory and the Northwest Territories my priorities are the transfer of responsibilities for decision making to the two territorial governments and communities at a pace set by Northerners; to settle comprehensive native land claims; to support economic development opportunities — especially as they translate into jobs for Northerners; and to enhance Arctic sovereignty.

These elements are interrelated and require a continuation of the cooperative approach that has characterized federal-territorial government relations in recent years.

There has been significant progress in ensuring close federal-territorial government cooperation, greater community involvement, increased opportunities for northern participation and employment, and greater sensitivity toward environmental and native concerns.

A number of positive developments in 1986 will help to lay the groundwork for a higher level of oil and gas activity in the years ahead. The Canada Petroleum Resources Act should be proclaimed in 1987. The new act will give legal force to the government's Frontier Energy Policy, which was announced by the ministers of Indian Affairs and Northern Development and Energy, Mines and Resources in October 1985. The new act will provide a simplified regulatory framework for the northern oil and gas industry.

Exploration activity in 1986 began on a high note in January when Gulf followed up its exploration success at Amauligak in the Beaufort Sea with two promising delineation wells. These were among 40 wells drilled on northern frontier lands in 1986, eleven of which resulted in significant discoveries.

The first shipment of Beaufort Sea oil occurred this year, when more than 50 000 cubic metres produced from extended flow tests on Gulf's second delineation well at Amauligak were shipped to markets in Japan.

Panarctic shipped more than 16 000 cubic metres of oil from its Bent Horn field in the High Arctic. This was the second shipment of oil from Bent Horn to southern markets. Although the scale of this project is relatively small, it continues to demonstrate the feasibility of commercial oil production in the remote Arctic during the open water season. Environmentally sound, Bent Horn serves as a model of cooperative planning involving industry, governments and Northerners.

In summary, while oil and gas exploration and development in the North are under economic constraints at present because of low prices, I am confident that a more favorable climate will prevail in the future.

In the meantime, I will work to preserve and enhance the partnership that has been nurtured among all parties, dedicated to making the North a better place for Northerners and thereby strengthening Canada as a whole.

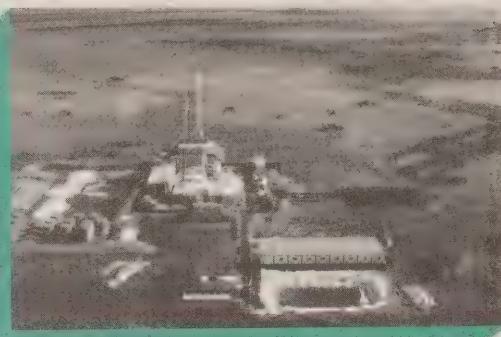


Minister Bill McKnight

A handwritten signature in cursive script, appearing to read "Bill McKnight". The signature is fluid and written in black ink on a plain white background.

Canada's Frontier Lands

Shell's Unak well in the Mackenzie Delta. Courtesy, Shell.



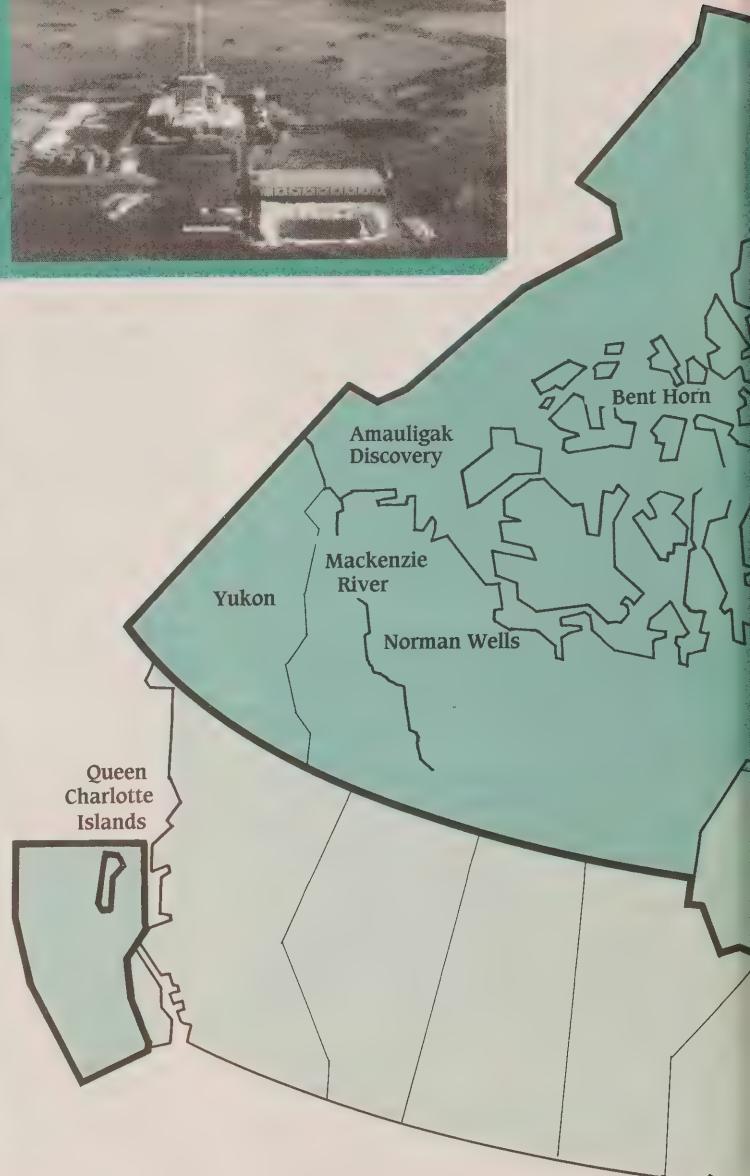
Loading of crude on the Gulf Beaufort at the Amauligak site in the Beaufort Sea. Courtesy, Gulf.



Artificial islands in the Mackenzie River at Norman Wells. Courtesy, A. Houde.



Harbor seals in the Strait of Juan de Fuca. Courtesy, D. Hardie.



Area administered by the Minister of Energy, Mines and Resources

Area administered by the Minister of Indian Affairs and Northern Development



Panarctic's West Cornwall well drilled from an ice platform in the Arctic Islands. Courtesy, Panarctic.



Fast rescue craft on the east coast. Courtesy, P. Davis.



Husky/Bow Valley's Bow Drill 5 operating on the Grand Banks. Courtesy, Husky/Bow Valley.



Flaring under way at Petro-Canada's Cohasset well located on the Scotian Shelf. Courtesy, Offshore Photo Service.



A Word from COGLA's Administrator, Maurice Taschereau



Mr. Maurice Taschereau

For COGLA, 1986 was a challenging and exciting year. We are all aware of the dramatic effects on the oil and gas industry caused by the sudden drop in the price of oil followed by an increase to levels that appear to offer the chance of stability and that if maintained, would allow continued activity in frontier areas.

We know that oil and gas resources are there on our frontier lands. We also know that the international petroleum industry looks upon Canada as a stable and secure country in which to explore and develop potential energy resources in the future.

During its five years of operation, COGLA has evolved and gained the experience required to regulate industry's energy initiatives more efficiently and responsively. The immediate challenge is to embody the total regulatory regime in legislation and regulations so that industry can get on with the job when the time is right.

The year 1986 was busy on several fronts. There were significant discoveries in the North and in the east coast offshore. In the North, Amauligak appears to be the major find that will catalyze development when conditions are appropriate. Panarctic again produced and shipped oil from the High Arctic. The Cohasset delineation well demonstrated the potential for producible oil reserves on the Scotian Shelf. Additional gas reserves were also established for the Venture project.

In April the West Coast Offshore Exploration Environmental Assessment Panel concluded that exploration offshore British Columbia north of Vancouver Island could be safely resumed, subject to certain conditions. The Georges Bank environmental screening study was completed and consultations between industry and the public began in the fall of the year.

The Canada Petroleum Resources Act is among the latest in a series of very positive legislative initiatives recently announced by the government. This act will address most of the questions and criticisms of the past few years by establishing a new regulatory framework for rights issuance that is fair, simple and open.

The Canada - Nova Scotia Offshore Petroleum Resources Accord was signed in August, providing for a new, independent board which will replace the existing Canada - Nova Scotia Offshore Oil and Gas Board. The board is to be established in 1987.

The Canada-Newfoundland Atlantic Accord Implementation Act was passed by the Newfoundland-Labrador legislature in June and is expected to be approved by Parliament in early

1987. It establishes a joint management and revenue sharing regime for offshore Newfoundland and Labrador. The Canada-Newfoundland Offshore Petroleum Board began operations in January and gave conditional approval to the Benefits and Development Plan for the Hibernia project in June.

Safety remains a watchword in the exploration and development of our offshore resources. The *Ocean Ranger Task Force Report* was submitted to the Minister of Energy, Mines and Resources in July. It recommended that action be taken to implement the Hickman Royal Commission's recommendations concerning the regulation of safety in the offshore.

At COGLA we are devoted to promoting safety, and, in this respect, 1986 has been a satisfying year. The PROD (Preferred Orientation and Displacement) lifeboat launching system was successfully tested. The Arctic Escape System, which can travel across water, pack ice and rubble, was satisfactorily tested in 1986.

The challenges faced by the men and women who develop the oil and gas potential of Canada's frontier lands are well known, and at COGLA we take pride in working with these resource pioneers to meet the challenges of the future.

I want to take this opportunity to congratulate Mr. Ted Baugh, Chairman of the Canada-Newfoundland Offshore Petroleum Board, on the excellent team of people he has put together in a very short time, to handle the challenges of administering and regulating oil and gas activity offshore in Newfoundland.

It is also appropriate to thank the very fine staff within COGLA who are dedicated to fulfilling their duties and responsibilities at a time when activity is declining and new agencies are being created to take over our operational responsibilities in specific regions.

A handwritten signature in black ink, appearing to read "Maurice Taschereau".

1986 Highlights

The Canada Petroleum Resources Act was approved by Parliament and given Royal Assent in November. Upon proclamation early in 1987, this new legislation will repeal and replace the 1982 Canada Oil and Gas Act, and simplify the regulatory framework for the disposition of frontier lands, royalties and the Canadianization of the oil and gas industry in the frontier lands. The new act will bring into law the government's frontier energy policy, announced by the ministers of Energy, Mines and Resources and Indian Affairs and Northern Development in October 1985.

The Canada-Newfoundland Atlantic Accord Implementation Act was passed by the Newfoundland legislature in June 1986 (Bill 1) and is expected to be approved by Parliament early in 1987. Upon proclamation, the Act will establish a regime for joint management and revenue sharing with respect to the exploration and development of petroleum resources offshore Newfoundland and Labrador. It will create the Canada-Newfoundland Offshore Petroleum Board (CNOPB), and give it authority to manage these offshore petroleum resources. The accord legislation incorporates the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act.

In August, Canada and Nova Scotia signed the Canada - Nova Scotia Offshore Petroleum Resources Accord, establishing a joint regime for the management and revenue sharing of offshore oil and gas resources.

Management of offshore oil and gas activities will be undertaken by a new independent Canada - Nova Scotia Offshore Oil and Gas Board. Legislation to implement the accord is being drafted and it is anticipated that it will be introduced into Parliament and the Nova Scotia legislature in 1987. As in the case of the Atlantic Accord, the legislation to implement the accord with Nova Scotia will incorporate the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act.

The Minister of Energy, Mines and Resources established a private sector task force to recommend how to implement several regulatory recommendations of the Hickman Royal Commission on the 1982 sinking of the *Ocean Ranger*. In its report, submitted in July, the task force outlined its recommendations on the form and substance of omnibus legislation to govern the regulation of oil and gas activities and to maintain, in a

given geographic region, a single regulatory agency responsible for the regulation of oil and gas operations on frontier lands. The recommended legislation, a Canada Oil and Gas Operations Act, would replace the current Oil and Gas Production and Conservation Act.

In April the Canada-Newfoundland Offshore Petroleum Board issued its first Call for Proposals for exploration rights offshore Newfoundland. The call resulted in the awarding of three Exploration Agreements. The work programs call for expenditures totaling \$4.75 million.

In June a Call for Proposals was issued for exploration rights offshore Sable Island, the second call in as many years. In October, the present Canada - Nova Scotia Offshore Oil and Gas Board evaluated the proposals received and awarded exploration rights on a single parcel to a consortium led by Petro-Canada.

In April the West Coast Offshore Exploration Environmental Assessment Panel issued its findings based on the public review of renewed exploration offshore British Columbia north of Vancouver Island. The panel recommended that exploration be undertaken subject to certain conditions.

In 1986 COGLA completed an environmental screening study to assess the potential environmental effects of exploration on the Georges Bank. The screening, done in consultation with federal and provincial departments, was requested by the Canada - Nova Scotia Offshore Oil and Gas Board. COGLA released the environmental screening and a technical discussion paper in May, and industry began public consultations in the fall.

During 1986, fifty-six exploratory and delineation wells were drilled on frontier lands, nine fewer than in 1985. There were 14 significant discoveries, 11 in the North and three in the east coast offshore. The most important of these were gas discoveries — Esso's Minuk in the Beaufort Sea and Shell's North Triumph on the Scotian Shelf.

The Norman Wells facility produced more than 1.4 million cubic metres of oil and 188 000 cubic metres of gas in 1986. In September an in-fill drilling program was started, and 22 wells were scheduled to be drilled by April 1987. Fourteen wells were drilled and completed at Norman Wells in 1986.

1986 Highlights

The most important exploration news in 1986 was the continued success of Gulf at the Amauligak structure in the Beaufort Sea. The first delineation well at the Amauligak site was completed in January and successfully flowed oil and gas. A second delineation well, drilled from the same surface location, flowed oil and gas from the same general interval. Three extended flow tests conducted at the second delineation well provided new knowledge about the reservoir characteristics in the structure. Oil produced from these tests was subsequently transferred from the drilling unit to the tanker *Gulf Beaufort*. Approximately 50 400 cubic metres of oil were marketed in Japan, the first shipment of Beaufort Sea oil.

Results at the Petro-Canada Cohasset A-52 delineation well were also exciting. The well flowed oil at rates up to 1 220 cubic metres per day and demonstrated the potential for oil development opportunities in the gas-prone Scotian Shelf.

During the year, exploratory drilling continued in search of additional reserves for the Venture Gas Project. Mobil successfully delineated one of the fields contributing to the project, the Thebaud gas field, finding gas in previously untested zones.

In June the CNOPB released its first *Decision Report* giving conditional approvals to the Benefits and Development Plan application submitted by Mobil and its partners for the Hibernia Development Project.

Panarctic again shipped about 16 450 cubic metres of oil from its Bent Horn oil field in the High Arctic. The *MV Arctic* transported the oil to Little Cornwallis Island, where open water allowed the transfer of the crude to a conventional tanker for shipment to Montreal.

Testing of the prototype PROD (Preferred Orientation and Displacement), a lifeboat launching system designed to improve rig evacuation capability, was successfully completed in 1986. The fishing-pole - like device, an add-on component to the lifeboat launching system, was installed aboard the semisubmersible drilling unit *Bow Drill 3* operating on the Grand Banks.

Testing of the prototype Arctic Escape System, an amphibious vehicle that can travel over open water, ice floes and ice rubble in Arctic waters, began in 1986. COGLA, the Department of Regional Industrial Expansion and industry cooperated in developing the system.

CGLA was involved this year in the development of a Canadian Standards Association Code for the design, construction and installation of fixed offshore production platforms. The code will assist in the development of regulations for Canada's frontier lands.

Federal-Provincial-Territorial Management of the Frontier Lands

Newfoundland and Labrador

The Atlantic Accord

The Canada-Newfoundland Atlantic Accord Implementation Act was passed by the Newfoundland legislature in June (Bill 1) and is expected to be approved by Parliament in early 1987. Upon proclamation, the act will establish a regime for joint management and revenue sharing for the exploration and development of petroleum resources in offshore Newfoundland and Labrador. It will create the Canada-Newfoundland Offshore Petroleum Board (CNOPB), which will be responsible for operational matters related to the management of the offshore petroleum resources.

To ensure continuity and stability for the petroleum industry operating in the area, the act incorporates the provisions of the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act, and their respective regulations.

Canada-Newfoundland Offshore Petroleum Board

The CNOPB, which manages the petroleum resources in offshore Newfoundland and Labrador, is now fully operational, and has established an office in St. John's.

The CNOPB cooperates with COGLA in many areas to ensure that regulatory practices offshore Newfoundland are consistent with Canada-wide practices. Memoranda of Understanding are being developed between the CNOPB and federal and provincial departments to ensure effective coordination in the areas of environment, fisheries, benefits and marine safety.

In its first annual report for 1985-86, released in April 1986, the CNOPB noted the following highlights:

- the submission of its *Decision Report* on the Hibernia Benefits and Development plans in which the board provided conditional approval for the proposed project;
- the first Call for Proposals and completed negotiations with Exploration Agreement holders on second-term or 'successor' exploration agreements.

Nova Scotia

The Canada - Nova Scotia Offshore Petroleum Resources Accord

The Canada - Nova Scotia Offshore Petroleum Resources Accord between Canada and the Province of Nova Scotia was signed on August 26, 1986. The



45-clause accord replaces the 1982 Canada - Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing.

The accord provides for joint management by an independent board appointed by both governments. The five-member board will make decisions on all matters directly related to the management of petroleum resources offshore Nova Scotia.

Certain board decisions are considered fundamental and will be subject to review and approval by both governments. These are:

- Calls for Proposals and the issuance of exploration licences;
- setting terms and conditions of significant discovery and production licences; and
- final approval of development plans.

Within the Sable Island 'footprint' and the Nova Scotia portion of the Bay of Fundy, however, these fundamental decisions need the approval of only the Nova Scotia Minister of Mines and Energy.

To ensure continuity and stability for the petroleum industry operating in the area, the implementing legislation will incorporate the provisions of existing federal legislation and regulations.

Canada - Nova Scotia Offshore Oil and Gas Board

The present seven-member Canada - Nova Scotia Offshore Oil and Gas Board met seven times during the 1986 calendar year.

Signing of the Canada - Nova Scotia Offshore Petroleum Resources Accord on Halifax on August 26, 1986. From left, federal Energy, Mines and Resources Minister Marcel Masse, Prime Minister Brian Mulroney, Nova Scotia Premier John Buchanan and provincial Mines and Energy Minister Joel Matheson.

Federal-Provincial-Territorial Management of the Frontier Lands

In early 1986 the board issued a Call for Nominations offshore Nova Scotia. In June a Call for Proposals was issued by the board for exploration rights on four parcels of land offshore Sable Island. The call, which closed in October, was the second issued by the board, and carried a \$1 million minimum acceptable work bonus for each parcel. The 1986 issuance resulted in the awarding of exploration rights for one parcel to a consortium led by Petro-Canada. The work program calls for expenditures of \$1.085 million.

The board also approved terms and conditions for nine second-round Exploration Agreements. They extend first-round Exploration Agreements for further terms of either three or four years.

New Canada benefits guidelines for the Nova Scotia offshore region were approved by the board. These guidelines deal with purchasing and employment principles as well as specific Canada and Nova Scotia benefits reporting requirements.

The board requested an environmental screening statement to assist it in assessing the potential effects of exploratory drilling on Georges Bank. The screening statement was developed by COGLA in cooperation with the Canada - Nova Scotia Environmental Coordinating Committee and in consultation with other federal and provincial departments.

The board approved levies for the Environmental Studies Revolving Fund, and reviewed projects proposed for this fund during 1986.

In January the board initiated a program that requires oil and gas operators to make certain levels of expenditures in research and development, and education and training in relation to the area of their land holdings. This program was implemented under the 1984 Canada - Nova Scotia Oil and Gas Agreement Act.

Yukon Territory and Northwest Territories

In 1986 COGLA continued to build stronger working relationships with the territorial governments, communities and special interest groups in keeping with the spirit of the frontier energy policy tabled in the House of Commons in October 1985. The focus for this involvement has been the ongoing discussions on the competitive bidding procedures for the issuance of new exploration rights.

COGLA and the Government of the Northwest Territories worked closely to explain to interested communities the rights issuance process and to discuss socioeconomic benefits and environmental protection matters. Fort Norman and Arctic Red River — the latter with the Mackenzie Delta Regional Council — each expressed interest in possible new

rights issuance in their respective areas. The Northwest Territories and the Northern Affairs Program of the Department of Indian Affairs and Northern Development provided funding so Fort Norman could hire a consultant to identify and evaluate equity participation possibilities. Discussions of possible Calls for Proposals for new exploratory rights with Fort Norman, Fort Franklin and Arctic Red River/Mackenzie Delta Regional Council were under way during the latter part of the year.

The city of Whitehorse, the local Kwanlin Dün Band, and a local company expressed interest in a possible Call for Proposals in the Whitehorse Basin area.

Work continued during the year on the Call for Proposals for the issuance of exploration rights near Fort Good Hope. The call closed in February, and a committee of federal and N.W.T. officials evaluated the bids and submitted its recommendation to the Minister of Indian Affairs and Northern Development.

Rights Management

COGLA is responsible for the issuance, administration, transfer and registration of oil and gas exploration and production rights on frontier lands. It also administers, for the Minister of Energy, Mines and Resources, certain federally owned mineral rights within the provinces.

During 1986 COGLA's rights management activities focused on developing terms and conditions for second-term or 'successor' exploration agreements whose original terms expired during the year. This year, the two offshore petroleum boards and COGLA concluded 23 agreements. COGLA also issued a production licence to facilitate Gulf's production testing operations at its Amauligak discovery in the Beaufort Sea.

Oil and gas companies returned to the Crown about 39 million hectares of land held under exploration rights during the year. This was the result either of relinquishment requirements in the initial Exploration Agreements or voluntary surrenders. These surrenders reflect not only the high exploration risks in some frontier areas, but also the industry's poor financial situation because of slumping world oil prices.

A Call for Proposals for the issuance of exploration rights in the Fort Good Hope area of the Northwest Territories closed in February. New exploration rights for Crown reserve lands were issued to industry after Calls for Proposals were made for parcels offshore Nova Scotia and offshore Newfoundland and Labrador.

The Canada - Nova Scotia Offshore Oil and Gas Board accepted Petro-Canada's bid for one parcel offshore Nova Scotia as a result of the call which closed October 8, 1986.

The Canada-Newfoundland Offshore Petroleum Board issued exploration rights for three parcels offshore Newfoundland and Labrador as a result of its first Call for Proposals, which closed in February, 1986.

During 1986 COGLA continued to consult agencies and industry about the drafting of regulations to be promulgated under the Canada Petroleum Resources Act dealing with rights registration; issuance and administration; and land descriptions and surveys.



Evaluation of technical data during land relinquishment process.

Rights Management

FRONTIER LAND HOLDINGS (At Year's End)	1982	1983	1984	1985	1986
Number of Exploration Agreements Active*	47	120	153	150	118
Lands Negotiated into Exploration Agreements (millions of ha)	35.8	25.0	21.2	24.9	4.1
Lands Relinquished or Surrendered (millions of ha)	N/A	1.6	24.7	20.0	39.2
Lands Active* (millions of ha)	134.2	115.4	89.5	70.8	33.5

*Includes declared significant discovery areas.

LAND STATUS AT YEAR END, 1986

	Active Exploration Agreements*	Lands Relinquished or Surrendered (millions of ha)	Lands Negotiated into Exploration Agreements (millions of ha)	Lands Active* (millions of ha)	Pending Lands** (millions of ha)
Mainland Territories	30	3.3	0	5.7	1.1
Mackenzie Delta and Beaufort Sea	23	3.1	0	4.2	0
Arctic Islands and Eastern Arctic Offshore	21	8.9	0.9	7.5	4.5
Hudson Bay	2	11.5	0	11.6	1.4
Grand Banks and Labrador Sea	27	9.2	1.5	3.4	1.5
Nova Scotia Offshore (includes Gulf of St. Lawrence)	15	3.2	1.7	1.1	3.4
West Coast	0	0	0	0	8.7
Total	118	39.2	4.1	33.5	20.6

*Includes declared significant discovery areas.

**Pending includes areas where exploration activity has been suspended: West Coast, Baffin Bay, Georges Bank, St-Pierre et Miquelon, etc.

EXPLORATION AGREEMENTS NEGOTIATED IN 1986

Operating Company	Exploration Agreement #	Number of Agreements	Area (thousands of ha)	Location	Term (years)	Well Commitment
Shell	275-278	4	558	Scotian Shelf	3	2
Mobil	279	1	226	South Sable	4	—
Mobil	280	1	271	Scotian Shelf	3	—
Dome	281	1	120	East Sable	3	—
Chevron	282	1	139	P.E.I.	3	—
Mobil	283	1	186	Sable Island	3	2
Petro-Canada	284	1	85	Western Shelf	4	—
Petro-Canada	285	1	67	Banquereau	3	—
Scotia Energy	286	1	46	Chebucto	3	—
Texaco	287	1	50	Albatross	4	—
Mobil	288-292	5	397	Grand Banks	4	8
Petro-Canada	293	1	35	Grand Banks	4	2
Shell	294	1	459	Grand Banks	7	1
Amoco	295	1	440	Grand Banks	7	1
Esso	296	1	189	Grand Banks	8	1
CMO	297	1	931	Lancaster Sound	8	—

Exploration Activity

In 1986, 56 exploratory and delineation wells were terminated on frontier lands, nine fewer than in 1985. Of these wells, 40 were in the northern region and 16 were in the east coast offshore. There were 14 significant discoveries, 11 in the North, and three in the east coast offshore.

Mainland Territories

There was considerable exploration in the southern Territories and the Mackenzie Valley for the third consecutive year. Thirteen exploratory wells and one delineation well were completed, and three wells drilled in previous years were re-entered for testing. This activity resulted in four significant gas discoveries. In the southern Territories, Paramount made two finds in the Cameron Hills area testing gas with minor amounts of oil, and Northcor successfully tested gas at its Liard F-25A well. Another gas discovery was made by Petro-Canada at Bele O-35, north of Norman Wells.

Petro-Canada tested two delineation wells at the site of its 1984 Tweed Lake gas discovery, northeast of Norman Wells. One well successfully tested gas.

There were 11 unsuccessful exploratory wells: two in the Colville Hills, four northwest and south of Norman Wells in the Mackenzie Plain, four in the southern Northwest Territories, and one in the Liard Plateau area.

Mackenzie Delta - Beaufort Sea

In the Mackenzie Delta - Beaufort Sea region, 24 wells – 15 exploratory and nine delineation – were terminated in 1986. There were seven discoveries: two gas, and one oil and gas in the Mackenzie Delta; and one gas, two oil, and one oil and gas in the offshore Beaufort Sea.

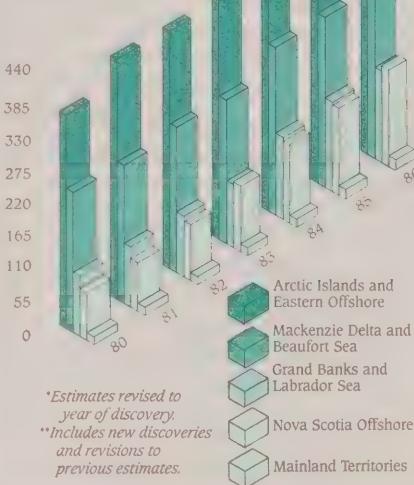
Esso made two oil and gas discoveries from several zones within the same general interval, at the Hansen G-07 onshore well in the Mackenzie Delta and at the Arnak K-06 well in the offshore Beaufort. Maximum oil rates at Arnak K-06 were as high as 71 cubic metres per day and gas rates at Hansen G-07 as high as 663 000 cubic metres per day.

Onshore in the Delta, Shell's Unak L-28 well was abandoned after testing gas, and Gulf's Ikhil K-35 well tested small amounts of gas.

Offshore in the Beaufort Sea, oil was recovered from Dome's Havik B-41 exploratory well and Gulf's Amauligak I-65A exploratory well. Esso's Minuk I-53 test flowed gas from a single zone at rates of up to 737 000 cubic metres per day.

Discovered Gas Resources by Region on Frontier Lands

1980-1986
(billions of m³)*

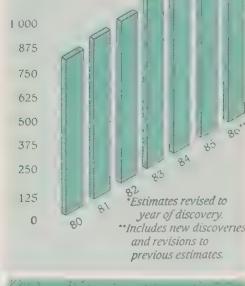


*Estimates revised to year of discovery.

**Includes new discoveries and revisions to previous estimates.

Cumulative Discovered Gas Resources on Frontier Lands

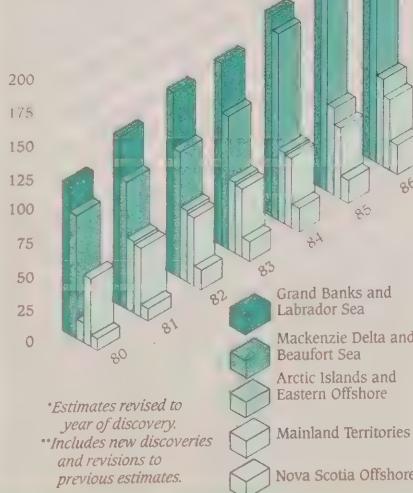
1980-1986
(billions of m³)*



*Estimates revised to year of discovery.
**Includes new discoveries and revisions to previous estimates.

Discovered Oil Resources by Region on Frontier Lands

1980-1986
(millions of m³)*

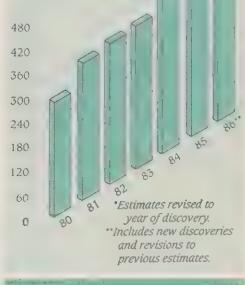


*Estimates revised to year of discovery.

**Includes new discoveries and revisions to previous estimates.

Cumulative Discovered Oil Resources on Frontier Lands

1980-1986
(millions of m³)*

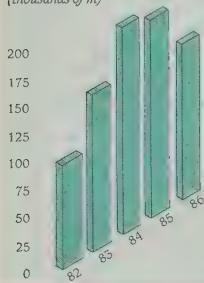


*Estimates revised to year of discovery.
**Includes new discoveries and revisions to previous estimates.

Exploration Activity

Exploratory Drilling on Frontier Lands

1982-1986
(thousands of m³)



Six of the nine delineation wells drilled in 1986 were follow-up tests to Esso's Tuk J-29 Tertiary oil discovery of 1985. Results in the six wells varied widely. Although Tuktuk D-11 flowed a maximum of 190 cubic metres of oil per day, several wells would not flow, and several yielded only shows of oil.

Esso's Adgo G-24 delineation well also tested gas at an average rate of 565 000 cubic metres per day. Gulf's first delineation well at Amauligak, the I-65, tested oil up to 1 186 cubic metres per day with associated gas. The second delineation well, Amauligak I-65B, tested oil on extended flow rates up to 2 067 cubic metres per day.

Arctic Islands - Eastern Arctic

In the Arctic Islands, Panarctic drilled two unsuccessful exploratory wells from artificially made ice platforms. The two wells are the last wells in Panarctic's program. For the first time since 1967, Panarctic closed its base camp at Rae Point, marking the end of a 19-year exploration drive in the High Arctic.

Newfoundland Offshore

Eight wells were terminated, and one well suspended during 1986. Six of these wells were exploratory; one resulted in a significant discovery. Husky/Bow Valley's Fortune G-57 well flowed oil from three different zones, at up to 786 cubic metres per day.

Delineation drilling resulted in a successful oil test at Petro-Canada's Terra Nova I-97, flowing oil at rates up to 790 cubic metres per day, and a successful gas well at Husky/Bow Valley's Whiterose L-61 which tested gas at rates up to 685 000 cubic metres per day. Husky/Bow Valley's North Ben Nevis M-61, a suspended delineation well, will be re-entered and tested in 1987.

Nova Scotia Offshore

Offshore Nova Scotia, eight wells were drilled to total depth during the year, four exploratory and four delineation. The four exploratory wells resulted in one gas discovery, one gas show and one oil discovery. Only the Shell Tantallon M-41 was a dry hole.

Shell's North Triumph G-43 discovery flowed gas at rates of up to one million cubic metres per day. North Triumph B-52, a delineation well, followed immediately, and flowed gas at rates up to 800 000 cubic metres per day.

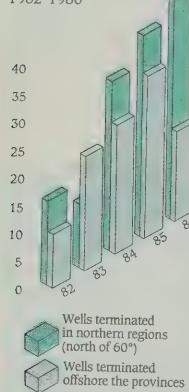
Shell's Panuke B-90 well was another success, flowing oil at rates up to 969 cubic metres per day.

Husky/Bow Valley tested gas at West Chebucto K-20, located just south of the North Triumph discovery. This well flowed gas at rates up to 187 000 cubic metres per day, but did not qualify for significant discovery status.

All four delineation wells offshore Nova Scotia were successful. In addition to the North Triumph well, Shell tested gas from its Glenelg N-49 well at rates up to 880 000 cubic metres per day. Mobil's delineation well, Thebaud C-74, flowed gas from several zones at rates as high as 1.3 million cubic metres per day. Petro-Canada also had success at the Cohasset A-52 delineation well. Oil was tested from several independent sands, with rates as high as 1 220 cubic metres per day. This oil was of good quality and testing demonstrated not only the potential for this type of geological structure but also the possibility for future development.

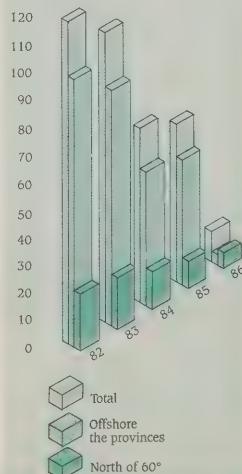
Number of Wells Terminated

1982-1986



Reflection Seismic Shot on Frontier Lands

1982-1986
(thousands of km)



Development Activity

Norman Wells - Mainland Territories

During 1986 the Norman Wells facility produced approximately 1 411 000 cubic metres of oil. Although the year's daily average for the field was 3 780 cubic metres per day, production in September increased to more than 4 000 cubic metres per day. Gas production during 1986 amounted to 188 000 cubic metres.

The original Phase Two drilling program was completed in March. In September, Esso started an in-fill drilling program and is scheduled to drill 22 wells by April 1987. Fourteen development wells were drilled and completed in 1986 at Norman Wells.

Preliminary design work has started to increase the capacity of the gas plant. The project is scheduled for completion before the end of 1987.

Pointed Mountain - Mainland Territories

The Pointed Mountain gas field, in production since 1972, had produced 7 675 million cubic metres of gas by the end of 1986. The field gas plant has a daily capacity of 5.4 million cubic metres. Total production for 1986 was 205 million cubic metres, compared with 226 million cubic metres in 1985.

Amauligak - Beaufort Sea

In February, Gulf announced the results of the first delineation well drilled at the 1984 Amauligak discovery. The well, Amauligak I-65, flowed oil and gas at high rates from multiple zones. The confirmation of proven reserves by the successful delineation drilling may qualify Amauligak as the lead project for Beaufort Sea development.

Gulf drilled two more wells, Amauligak I-65A and I-65B from the *Molikpaq*, a mobile arctic caisson. The operator conducted a drillstem test program and ran independent extended flow tests on three zones in the I-65B delineation well. The produced oil was flared on the first two extended flows because ice prevented a tanker from anchoring nearby. During the third test, however, the crude was produced into the MV *Gulf Beaufort* anchored alongside the *Molikpaq*. Approximately 50 400 cubic metres of oil was transferred to the tanker and subsequently transported via the north Alaskan route to Japan.

Gulf is considering further delineation drilling at Amauligak in 1987 and possible seasonal production in 1988.

Bent Horn - Arctic Islands

Oil was shipped from the Bent Horn facility for the second consecutive year with Panarctic's shipment of 16 450 cubic metres in September. The MV *Arctic*, an ice-class oil and bulk ore carrier, escorted by the Coast Guard icebreaker CCGS *John A. Macdonald*, transported the oil to Little Cornwallis Island. On the way, the MV *Arctic* unloaded 800 cubic metres of oil at Resolute to see if it can be used as fuel for the local diesel-electric generators. Should this test prove successful, Resolute and other Northwest Passage communities could benefit regularly from oil produced at the Bent Horn site.

The remaining crude was transferred at Little Cornwallis Island to a conventional tanker, the MV *Imperial Bedford*, and shipped to the Petro-Canada refinery in Montreal.

Production continued after loading, and the storage tanks were filled with 13 540 cubic metres of oil to await shipment in 1987. With production completed, Panarctic closed the Bent Horn facility again until the summer of 1987.

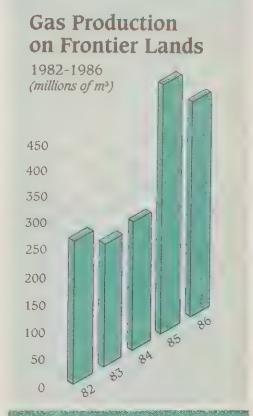
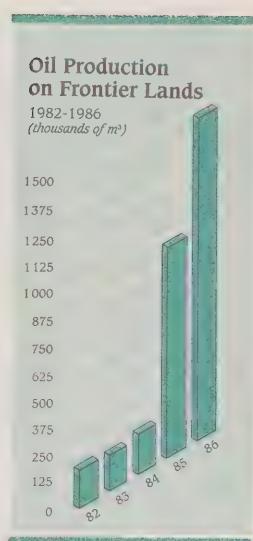
Hibernia - Newfoundland Offshore

In July the CNOPB approved Mobil's development plan, subject to certain terms and conditions. One significant condition was the insistence upon further evaluation of the Avalon reservoir and miscible flooding capabilities of the Hibernia reservoir.

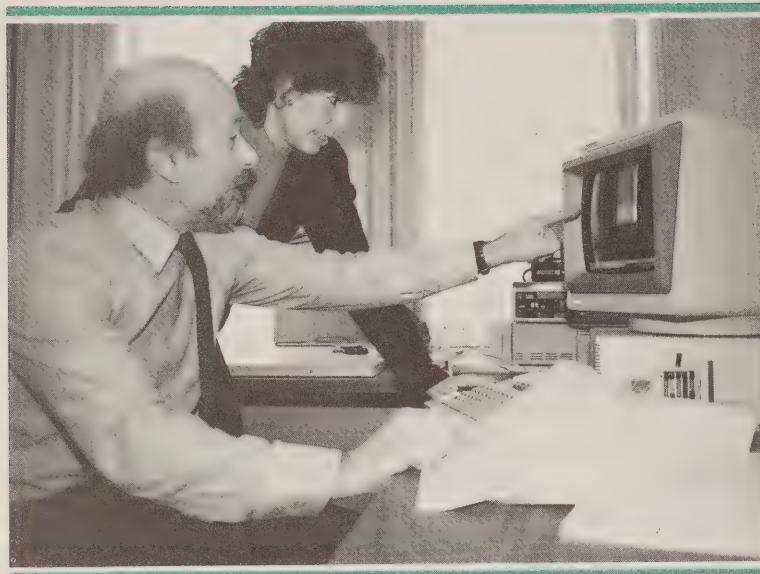
Although the depressed world market has made the scheduling for the project less certain, the target start-up date is still 1992. Most regulatory requirements have been met. At year end, fiscal negotiations between the sponsors and the federal and provincial governments were still under way.

Venture - Nova Scotia Offshore

This year Mobil drilled and tested a fourth Thebaud well, Thebaud C-74, which encountered a thick gas pay section with a maximum gas flow rate of more than 1.3 million cubic metres per day. This well has increased the probable recoverable reserves figure for Thebaud, and thus the recoverable gas reserves for the Venture Gas Project. Like most offshore development projects, slumping world oil markets are causing delays.



Conservation



COGLA production reservoir engineers assessing well logs.

A key part of COGLA's mandate is responsibility for the conservation of oil and gas resources. This involves the review of well log and drillstem test analysis of oil and gas discoveries, reservoir performance for existing fields, evaluation of development plans (Venture gas field and Hibernia oil field), extended production tests (Amauligak I-65B), and a review of proposed developments such as the Tuk gas development, and the Cohasset oil field.

Norman Wells Oil Field

COGLA uses a computerized production data base to monitor production and injection data from the Norman Wells oil field. This, in conjunction with geological and engineering data, is used to evaluate reservoir performance. When sufficient data are gathered to establish trends, a reservoir simulation study will be used to analyze the performance of the field. Raw gas flaring has been reduced and will be essentially eliminated when additional modifications to the gas plant are made in 1987. Additional drilling in 1986-87 will increase the well count to 287: 130 injectors and 157 producers.

Venture Gas Field

COGLA completed a detailed geological and reservoir analysis of the Venture gas field. This analysis was incorporated into a reservoir description, then modelled using a reservoir simulation package. This

allowed an extensive study of reservoir variations, gas flow characteristics, water movement and suitability for the selection of future production well sites.

A study of the occurrence of overpressuring on the Scotian Shelf was also completed. It identified many regional trends, and highlighted important relationships between well logging and the identification of abnormal pressures. This type of study is critical to drilling safety. It provides a better understanding of how overpressured gas reserves can be produced in anticipation of their contribution to offshore development. This study, along with other current research, will improve methods of determining reserve estimation, recovery efficiencies, reservoir descriptions and future completion practices.

Hibernia Oil Field

A detailed geological and reservoir engineering study was initiated in response to certain conservation issues resulting from the Hibernia Development Plan Application by Mobil. The possibility of a natural miscible flood occurring in the Hibernia sands was highlighted in this study. Such a situation could improve the recovery efficiency for this reservoir. The study also suggested that the potential of the Avalon reservoir might be greater than originally thought. Proposed gas flaring was thought to be excessive, particularly in light of the use of the gas resource for reinjection, if the miscible flood plan is implemented.

This material was presented in a recommendation report to the CNOPB. The board incorporated these issues into the terms and conditions attached to its *Decision Report* issued in June 1986.

Protection of the Worker

Regulations and Guidelines

Since its inception in 1981, COGLA has administered regulations promulgated under the Oil and Gas Production and Conservation Act that concern the health and safety of petroleum workers on frontier lands. In 1984 Parliament passed legislation consolidating the many laws which had regulated occupational safety and health in the federal jurisdiction into one legislative authority — Part IV of the Canada Labour Code. COGLA is working with Labour Canada to develop safety and health regulations tailored to the petroleum sector. It is also working with the Canadian Coast Guard to ensure that the safety and health regulations governing the marine aspects of offshore exploration are equivalent to those provided for the drilling personnel.

COGLA participates on the Canadian Standards Association steering and technical committees to develop a code for the design, construction and installation of fixed offshore production platforms. The preliminary code is expected to be issued in 1987. It will contain standards that reflect modern technology and thereby ensure a basic level of safety for oil field workers.

In September an updated version of the Guidelines and Procedures for Drilling for Oil and Gas on Frontier Lands was published. The document is intended to elaborate on pertinent regulations and

departmental procedures and policies. It includes recently formulated guidelines on oil-based drilling muds, physical environmental programs, medical and first aid supplies and industry training requirements. The guidelines are enforced in Newfoundland and Labrador by the Canada-Newfoundland Offshore Petroleum Board and throughout the rest of the frontier lands by COGLA.

Work is currently under way to develop guidelines for subsea systems, floating production systems, fixed offshore structures, and for pipelines and other structures in Arctic regions.

Standards for Mobile Offshore Drilling Units and Their Support Craft

Before allowing a mobile offshore drilling unit (MODU) to operate on Canada's frontier lands, a Letter of Compliance, or equivalent certification, from the Canadian Coast Guard (CCG) is required as evidence that the unit complies with the Canadian MODU standards. This is in addition to the certifications issued by the country of registry and the classification society.

Support craft must also be certified, and standby craft must carry special safety equipment and have a Letter of Compliance issued by the CCG. A draft of the standards respecting standby vessels is under review and is scheduled to be published in 1987.



Offshore workers undergoing survival training. Courtesy, P. Davis.

STATUS OF REGULATIONS PERTAINING TO SAFETY OF THE WORKER

Regulations	Scope	Status
Canada Oil and Gas Drilling Regulations	To govern safety and inspection aspects of drilling operations on Canada's frontier lands.	Currently being amended to incorporate relevant safety recommendations from the Hickman Royal Commission report, mobile offshore drilling unit (MODU) standards and advances in technology and equipment.
Canada Oil and Gas Production and Conservation Regulations	To govern safety and conservation practices in operations undertaken for the production of oil and gas on Canada's frontier lands.	Draft regulations are currently at Privy Council Office for examination and approval.
Canada Oil and Gas Geophysical Regulations	To govern safety and inspection aspects of geophysical operations and protect the environment on Canada's frontier lands.	Final draft was discussed with industry. Preparing to submit to Privy Council Office for examination and approval.
Canada Oil and Gas Production Installations Regulations	To govern safety and inspection aspects of the design, construction and maintenance of production installations used in the development and production of oil and gas on Canada's frontier lands.	Currently being drafted. Specific requirements to be included in these regulations will be developed with the help of consultants.
Canada Oil and Gas Occupational Safety and Health Regulations	To govern under the Canada Labour Code occupational health and safety of workers employed in the exploration, production, conservation, processing or transportation of hydrocarbons.	Draft regulations are currently at Privy Council Office for examination and approval.
Canada Oil and Gas Safety and Health Regulations	To govern occupation health and safety of workers employed in the exploration, production, conservation, processing or transportation of hydrocarbons in areas not subject to the Canada Labour Code.	First draft in preparation.
Canada Oil and Gas Diving Regulations	To govern safety and inspection aspects of diving operations offshore Canada's frontier lands.	Draft regulations are currently at Privy Council Office for examination and approval. Promulgation expected in 1987.
Canada Oil and Gas Offshore Pipeline Regulations	To govern safety and inspection aspects of the design, construction and maintenance of pipelines offshore Canada's frontier lands.	Draft regulations are currently under internal review.
Canada Oil and Gas Land Pipeline Regulations	To govern safety and inspection aspects of the design, construction and maintenance of pipelines onshore Canada's frontier lands.	To be drafted after the Offshore Pipeline Regulations have been reviewed by Privy Council Office.

Protection of the Worker



1986 open water trial of the 50-person Arctic Escape System.
Courtesy, Watercraft Offshore Canada Ltd.

Offshore Safety Task Force

In April the federal government responded to the recommendations of the Hickman Royal Commission on the *Ocean Ranger* marine disaster and announced that most of the recommendations had been implemented in whole or in part. The Minister of Energy, Mines and Resources at the time also announced the establishment of a private sector task force to assist in preparing recommendations to Cabinet on the most difficult of the Hickman recommendations. These recommendations are under review.

In its report, submitted in July to the Minister of Energy, Mines and Resources, the task force recommended changes to the legislation relating to the safety of oil and gas activities in the offshore. Should the recommendations of the task force be accepted, industry, territorial governments, and the Atlantic Provinces would be consulted on implementation.

Advisory Committees

In its effort to promote offshore safety, COGLA participates on various committees. The Frontier Lands Medical Advisory Committee oversees matters relating to offshore health, safety and medical support. It also assists in the development of COGLA regulations and directives affecting offshore health.

The Frontier Lands Safety Advisory Committee provides a joint government-industry forum for the review and promotion of safety-related matters concerning exploration and production activities on frontier lands. In 1986, this committee reviewed COGLA regulations and guidelines, medical guidelines, research and development programs, search and rescue capability, offshore standards and other safety-related matters.

Geopressure Drilling Task Force (GDTF)

A COGLA-industry task force was formed during the year to review and respond to the concerns expressed in the COGLA-commissioned report, An Examination of Safety Procedures and Practices Used in Exploratory Drilling Operations Conducted in Abnormally Pressured Formations in the Scotian Shelf Area. The mandate of the GDTF was to examine industry's technology and operating practices and to recommend practices to promote safety in geopressedured drilling. The major areas of study investigated by GDTF included pressure prediction, pressure detection, tubular design, well control equipment and procedures.

Safety Training

In August the Canadian Petroleum Association, after consultation with the Canadian Association of Oilwell Drilling Contractors, published guidelines for the training and qualifications necessary for each position on mobile offshore drilling units on Canada's east coast. The guidelines will set minimum requirements for all operators in the east coast offshore. The guidelines are referenced in the September 1986 edition of Guidelines and Procedures for Drilling for Oil and Gas on Frontier Lands.

COGLA also serves on a technical committee comprising the Petroleum Industry Training Service, the Canadian Association of Oilwell Drilling Contractors and other industry associations tasked with the development of a worker training program to protect against hydrogen sulphide. The program will familiarize oil field workers with the extremely toxic nature of hydrogen sulphide gas and instruct them in the procedures essential to safeguard human life when the gas is encountered.

Inspections

On-site inspections of each drilling unit are made during drilling operations to assess the safety and effectiveness of the operation and to ensure compliance with regulations and guidelines. In 1986 COGLA conducted 114 drilling unit inspections.

Periodic inspections were carried out at Norman Wells to ensure that the central processing facilities, refinery and other field facilities were operating safely and efficiently. A COGLA inspector was stationed on the *Molikpaq*, Gulf's mobile arctic caisson, during the period of the Amauligak I-65B extended flow test to monitor operations and to ensure compliance of the conditions imposed on the test.

Atmospheric Environment Service (AES) meteorological officers inspected and approved the installation of meteorological instruments on COGLA's behalf whenever drilling units were in port. When drilling units are on location, AES officers make regular inspections that include assessing meteorological observation procedures and verifying the calibration of instruments.

Contingency Planning

Under the Canada Oil and Gas Drilling Regulations, operators must provide contingency plans for emergencies. These plans cover various emergencies, such as: serious injury or death, fire, blowouts, loss or damage to the drilling unit and support craft, well control problems, pollution threats, hazards posed by ice encroachment, and collision with other vessels.

As in previous years, the operators conducted communications and practical field deployment exercises to test company and industry contingency plans. On one occasion, the collision avoidance procedures of an operator were tested by simulating a vessel approaching a drilling unit on a steady course. Inspectors located onshore and on the drilling unit monitored the company's response to an imminent collision as developments were presented to them from a scripted scenario.

In the Beaufort Sea, Gulf, Esso and Dome continued their cooperative arrangements for search and rescue, evacuation and response procedures for emergency situations.

Lost-Time Accidents

The number of lost-time accidents (LTAs) per million person-hours worked is used by industry and government agencies to compare the frequency of injury to personnel engaged in various industries.

In addition to the LTAs listed in the accompanying table, 26 others were reported on the frontier lands in exploration-related activities. Most of these occurred in the operators' support base.

There were no fatalities associated with oil and gas exploration in 1986.

Sea Ice and Icebergs

The 1985-86 ice season on the east coast differed markedly from the previous season. In 1986 the pack ice over the Hibernia area was looser and did not extend as far south. By the first of April, when the ice had retreated from the drilling area, only 1 000 hours of drilling time had been lost, compared with 8 000 in 1985. In 1986 only one hour of drilling time was lost due to icebergs on the Grand Banks, down from 43 days the previous year. On the Scotian Shelf ice caused no interruptions of drilling.

In the Beaufort Sea, thick ice floes struck the *Molikpaq* at the Amauligak site three times. Drilling operations were shut down twice and the crew was evacuated without incident. In the Beaufort Sea, ice breakup in July was a week early and open water conditions in August and September were more extensive than usual. The *Gulf Beaufort* remained at Amauligak until the extended flow test was completed in mid-September.

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1986

	Person-Hours at Work Site		Lost-Time Accidents		Accident Rate (LTA/Millions of Person-Hours)	
	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel
Mainland Territories	347 556	N/A	8	N/A	23.02	N/A
Mackenzie Delta and Beaufort Sea	1 150 800	344 428*	27	5	23.46	14.52
Arctic Islands and Eastern Arctic Offshore	87 840	N/A	6	N/A	68.31	N/A
Grand Banks and Labrador Sea	1 065 928	416 294	13	13	12.20	31.23
Nova Scotia Offshore	652 120	217 018	20	4	30.67	18.43
Total	3 304 244	977 740	74	22	22.40	22.50

*Estimated.

Protection of the Worker



The Preferred Orientation Displacement (PROD) device installed on Husky/Bow Valley's Bow Drill 3.

Research and Development

Research and development (R&D) is essential to COGLA's regulatory functions. Established technologies are often used in unusual environments, and new technologies often need to be developed, assessed and implemented for Canadian conditions.

The Program for Energy Research and Development (PERD) ensures, through R&D, that there is suitable technical knowledge for the federal government to fulfil its responsibilities relating to the supply of crude oil, natural gas and electricity.

In 1986 COGLA administered several major R&D projects under the PERD program, chaired the PERD Marine Engineering R&D Committee and was active on the geoscientific, offshore geotechnical, materials, transport and environment committees. Research studies and projects were initiated on rig evacuation; ice structure interaction; protection of pipelines; standards for the design, construction and installation of offshore structures; the recovery of rescue craft and lifeboats; and an improved personnel transfer basket.

Preferred Orientation and Displacement (PROD) Lifeboat Launching System

The PROD system, developed by the U.K. lifeboat manufacturer Water Craft Ltd., is an add-on device that moves a lifeboat out and away from the drilling unit as it is being lowered. This minimizes the risk of collision between the lifeboat and the drilling unit.

This R&D program responds to recommendation 22 of the *Ocean Ranger* report, which asked that a system be developed, with the utmost priority, to evacuate people from rigs safely.

Since 1985 COGLA has cooperated with the east coast operators and the governments of Nova Scotia and Newfoundland and Labrador in the funding of full-scale sea trials of PROD aboard *Bow Drill 3*. COGLA contributed 45 per cent of the funds. The U.K. Department of Energy also joined the project later and contributed monetarily.

Sea trials finished in October after 64 successful launches. Results of the test program confirmed that the PROD concept is suitable for use on mobile offshore drilling units and, with modifications, may also be applicable to offshore production platforms. COGLA anticipates that the concept will be approved for installation in early 1987.

Personnel Transfer Basket

A joint government-industry project, initiated in 1985 to develop an improved personnel transfer basket, is scheduled for completion in 1987.

The improved basket has been designed to provide a safer method of transferring people between a drilling unit and its standby vessel. A helicopter or the rig crane is used to support the basket during transfers.

Arctic Escape System

A prototype of the Arctic Escape System (AES) was constructed in 1986. The vehicle can evacuate 50 people from a drilling unit and move across open water, unconsolidated ice and ice rubble fields known to build up around drilling units in the Arctic. After preliminary stability trials, the vehicle was shipped to Tuktoyaktuk where it underwent field trials, and further north in Viscount Melville Sound where it was tested in pack ice by the Canadian Coast Guard. The AES exceeded the design performance criteria. It generated a large quantity of performance data that will be useful in modifying the design to improve passenger comfort.

The system was jointly funded by Canadian and American arctic petroleum operators, the Department of Regional and Industrial Expansion, and by COGLA through the Program on Energy Research and Development of EMR.

Fast Rescue Craft Deployment Project

Early in 1986 COGLA participated in a study of east coast standby vessels to assess their capability to safely launch and recover their fast rescue craft (FRC) in seas up to eight metres. These boats have good sea-keeping qualities and are used to recover people from the water or from lifeboats.

The second phase of this joint government-industry project involves modifying a standby vessel and conducting sea trials to assess the effect on the ship's capability to safely deploy its FRC and crew.

Protection of Drilling Structures in the Arctic

Recent ice events at the site of the *Molikpaq* have shown the importance of a proper understanding of soil behavior and the use of suitable mathematical models for building safe structures in the Beaufort Sea. Predictions on ice-soil, seabed-structure interactions differed from the actual behavior of the *Molikpaq* structure. COGLA will be participating in several studies to learn more about the analysis of seabed-structure interaction.



Protection of the Environment

On the East Coast

Hibernia Environmental Review

In December 1985 the Hibernia Environmental Assessment Review Panel issued its report evaluating the environmental and social effects of the Hibernia Development Project. The report, containing 50 recommendations, concluded that the Hibernia Development could go ahead safely. In January COGLA, the Newfoundland-Labrador Petroleum Directorate and the CNOPB started a joint review of the panel's report and recommendations.

COGLA's review of the environmental aspects of the report was incorporated into the CNOPB's *Decision Report*. The CNOPB required that Mobil prepare an environmental protection plan for CNOPB approval to describe the environmental protection measures and programs proposed for the Hibernia project. The company will update the plan during evaluation of the design as details are defined or as procedures for environmental management are confirmed.

Georges Bank

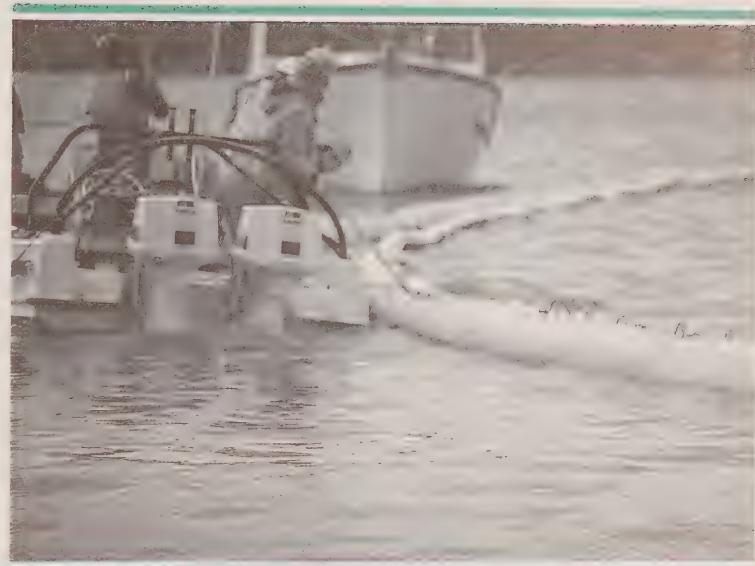
Following the resolution of the international boundary dispute between Canada and the United States in 1984, industry expressed interest in conducting exploratory drilling on the Canadian Georges Bank.

At the request of the Canada - Nova Scotia Offshore Oil and Gas Board, COGLA undertook an evaluation of the environmental effects associated with proposed exploratory drilling. The evaluation, or screening statement, was completed with technical assistance from the Canada - Nova Scotia Environmental Coordinating Committee, which includes representation from federal and provincial departments that have an interest in the management of offshore resources.

The screening statement concluded that exploratory drilling could take place safely, provided that certain operating conditions, to be addressed during the regulatory approvals process, were implemented.

The report was released in May 1986 and fulfilled the federal Environmental Assessment Review Process requirement that projects such as offshore exploration be screened to identify potential adverse environmental effects. A technical backgrounder to the screening statement was also prepared and released which considered the environmental implications of renewed exploration on Georges Bank.

Both reports were distributed to the oil and gas industry, the fishing industry, other government



agencies in Canada and the United States, and the public. Texaco, the company interested in exploratory drilling on Georges Bank, initiated public consultation in the fall.

Exercise conducted into oil spill contingency measures. Courtesy, B. Bailey.

On the West Coast

Environmental Review Panel

In April the West Coast Offshore Exploration Environmental Assessment Panel issued its report on offshore hydrocarbon exploration in Queen Charlotte Sound, Hecate Strait and Dixon Entrance off British Columbia. The panel concluded that exploration could proceed in an environmentally acceptable manner, subject to certain recommendations.

A federal committee chaired by COGLA was established in May to coordinate the federal government's response to the panel's recommendations. The British Columbia Ministry of Energy, Mines and Petroleum Resources formalized and consolidated the provincial review. The ministry and COGLA are coordinating the preparation of an intergovernmental response that will be submitted to the ministers of energy in early 1987.

In the North

Bent Horn

In 1986 Panarctic again received approval to extract and ship oil from Bent Horn. The Canadian

Protection of the Environment



*Cape Scott on Vancouver Island.
Courtesy, D. Hardie.*

Giant mussels on Queen Charlotte Island. Courtesy, D. Hardie.



Coast Guard reviewed Panarctic's updated Maritime Contingency Plan, while COGLA, in consultation with the Department of Indian Affairs and Northern Development, reviewed and approved the company's revised Environmental Protection Plan.

Amauligak I-65B Extended Flow Test and Transportation

In April Gulf received approval to conduct an extended flow test from the I-65B well and to ship the oil west through the Beaufort Sea.

COGLA coordinated and participated in the review of Gulf's environmental alert procedures manual and oil spill contingency plans. These were developed specifically for the project by the company with the support of other federal government agencies, including the Government of the Northwest Territories. Review of these documents and environmental operating terms and conditions for the project were also developed in consultation with the Environmental Impact Screening Committee of the Committee for Original Peoples Entitlement.

Consultations

Guidelines

In 1986 COGLA was active in preparing guidelines in consultation with industry and other government departments for the treatment and discharge of wastes from exploration and production operations. The guidelines will detail and facilitate the application of regulations to protect the marine environment from toxic chemicals. These regulations include the Canada Oil and Gas Drilling Regulations, the Canada Oil and Gas Production and Conservation Regulations, and the Canada Oil and Gas Offshore Pipeline Regulations. Detailed environmental screening procedures for petroleum activities under the Federal Environmental Assessment and Review Process were also prepared.

Other environmental guidelines to address environmental monitoring objectives and procedures for oil spills are being prepared. Guidelines dealing with well site surveys, meteorological, oceanographic and ice programs, contingency planning, and the use of explosives and oil-based drilling muds continue to be evaluated and updated periodically.

Environmental Consultation

The new Canadian Environmental Committee on Petroleum Activities, the forum for inter-departmental liaison on environmental matters, was established in the summer of 1986. It replaces the Resource Management Environmental Committee. Its members represent COGLA, including its regional offices, federal-provincial offshore boards, and five federal government departments: Energy, Mines and Resources, Indian Affairs and Northern Development (Northern Affairs Program), Environment, Fisheries and Oceans, and Transport. The committee's chief concerns are exchange of information, development of technical guidelines, and consistency of the environmental regime for oil and gas on the frontier lands.

Environmental Assessment

In 1986 COGLA continued to be an active member of the Federal Environmental Assessment Review Office Committee on Environmental Assessment and is also active on several technical subcommittees with responsibility for evaluating environmental impact assessment methodologies, techniques, processes and procedures as they relate to activities on Canada's frontier lands.



Environmental Studies Revolving Funds (ESRF)

The ESRF supports environmental and social studies related to oil and gas developments on frontier lands. The program focuses exclusively on research needed for decision making in oil and gas exploration and development. The program, administered by COGLA, is funded through a levy on oil and gas companies that hold interests on frontier lands.

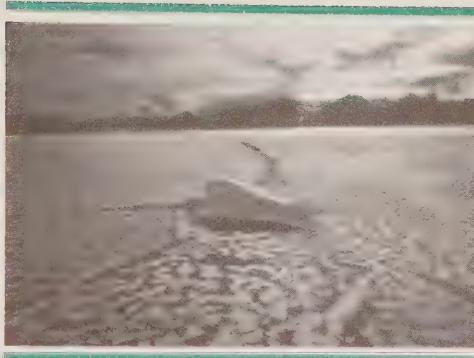
Under the Canada Petroleum Resources Act, the name of the program will become the Environmental Studies Research Fund. The ESRF advisory boards will become one management board with one chairperson. Currently, the boards are chaired alternately by DIAND and COGLA representatives. The membership of the new management board will be expanded to include representatives of the Canada-Newfoundland Offshore Petroleum Board, the Canada - Nova Scotia Offshore Oil and Gas Board, representatives from the appropriate territories and provinces and two members of the public. The management board will meet at least twice a year. An executive committee consisting of the board chairperson, vice chairperson and a third member will handle short-term issues.

ESRF addresses 'environmental' issues in the broadest possible sense – including physical, biological and socioeconomic studies. About 60 studies were under way in 1986.

In 1986 the ESRF had a budget of \$2.3 million for six studies, compared with \$4.2 million for 40 studies in 1985 and \$6.6 million for 36 studies in 1984.

Some of the studies currently under way or recently completed include:

- *Nearshore Sediment Dynamics in the Beaufort Sea.* This field study is investigating sediment transport processes in shallow water areas. The geotechnical and oceanographic data collected will be used to determine engineering design criteria for offshore structures and pipelines.
- *The Beaufort Sea Dispersant Trial.* Four crude oil spills were created. The spills were treated with two different commercial dispersants sprayed from helicopters to determine the effectiveness of this countermeasure in Arctic open water.
- *Distribution of Bowhead Whales in Relation to Hydrometeorological Events in the Beaufort Sea.* This study reported the results of an investigation of the relationship between the observed distribution of bowheads in the Canadian portion of the Beaufort Sea and the physical and meteorological patterns that might affect the



Iceberg located in Lancaster Sound, NWT.

distribution of zooplankton. The study aimed to identify easily monitored parameters that could be used to predict bowhead distribution and to explain possible interaction between the whales and nearby oil and gas industry activities.

- *Family Life Adaptations to Offshore Oil and Gas Employment.* This study documented the responses of families living in Newfoundland to rotational patterns of work associated with offshore oil and gas employment. Recommendations were made to alleviate possible problems.
- *The Use of Water Cannon in the Management of Small Ice Masses.* This study involves the installation and testing of high-pressure water cannon on a supply vessel off the east coast. This method of controlling small ice masses is an adaptation of technology developed for fire fighting offshore. It will provide an extra margin of safety by quickly and effectively intercepting and controlling small ice masses without putting the vessel's crew at risk.

Offshore Incidents

Minuk I-53

A report was issued in 1986 on an incident the previous September at Esso's Beaufort Sea Minuk I-53 sacrificial beach island (SBI). The report concluded that although the island performed to its design specifications, a review of the design wave climates used for future Beaufort SBIs should be undertaken. This recommendation was made in light of the storm that caused 60 per cent erosion and the spilling of about 380 cubic metres of diesel fuel. Recommendations also were made about operator and government alert procedures, as well as island construction and monitoring requirements for the open water season.

Employment and Industrial Benefits



Worker at Norman Wells.

In late 1986, the Canada - Nova Scotia Offshore Oil and Gas Board approved the Guidelines for Canada Benefit Approvals and Reports negotiated with members of the Canadian Petroleum Association. These guidelines formalize and standardize the principles and procedures for operators on frontier lands offshore Nova Scotia. Specifically, these principles and procedures govern an operator's activities where the minister deems that a formal Canada benefits plan is not necessary. The guidelines also call for the simplified reporting format which has already been used for the 1985 annual reports. A modification of the new format was also used for benefit plan submissions that accompanied program proposals for Exploration Agreements or renewals issued during the year.

The territorial governments are reviewing benefit guidelines. In this vein, COGLA and branches of DIAND are working closely with the Energy Secretariat of the Government of the Northwest Territories to devise ways and means to permit Northerners to play a more active role in benefit matters.

Benefits are directly related to exploration and development activity. When the level of activity falls rapidly, as it did during 1986, there can be considerable hardship and dislocation, particularly in regions heavily dependent on the oil and gas industry.

Because of the downturn, the benefits in 1986 came about mainly from existing exploration programs nearing completion, unlike in previous years when they were the result of new programs getting started.

Canadian Market Opportunities Program

The Canadian Market Opportunities Program (CMOP) represents the suppliers, buyers, contractors, consultants and associations that make up the petroleum industry.

CMOP has two principal objectives:

- to increase the participation of Canadian suppliers in petroleum industry activities; and,
- to encourage the development across Canada of domestic sources of supply for goods and services not currently provided by Canadians.

Since 1982 more than 70 organizations, including trade associations representing hundreds of industry members, have joined CMOP. COGLA supports this petroleum industry initiative and has representatives on the national executive and the Atlantic regional chapter.

Northern Developments

Esso's recently expanded Norman Wells oil field project continued production in 1986, despite the slump in crude oil prices. Esso resumed its infill drilling program at Norman Wells, using the services of Shehtah Drilling Ltd., a native-owned company to drill an additional 22 wells during the 1986 and 1987 drilling seasons.

The extended flow test by Gulf at Amauligak lengthened the work season and provided some unanticipated employment and contractual benefits. The large size of the discovery may bring many benefit opportunities once the price of oil rises sufficiently to encourage development of the field.

In the High Arctic, Panarctic's tanker shipment of crude petroleum to southern markets marked the second year of production from its Bent Horn project.

East Coast Developments

On the east coast, the CNOPB approved the Hibernia Benefits Plan as submitted by Mobil. The plan calls for full and fair opportunity for Canadians, with first consideration for Newfoundlanders, to participate in the provision of goods, services and employment.

The \$4.8 billion (1984 dollars) Hibernia project could result in significant economic benefits to the country since Canada can supply most of the required materials, equipment, services and contracting. Mobil has committed itself to several initiatives designed to improve the potential for Canadian contractors and suppliers to compete. The company completed its review of the Project Services Contractor and Topsides Engineering services require-

ments for Hibernia, short-listing five consortia. However, because of delays in the project, no further progress has been made on this or other major contracts such as the one for design and construction of the gravity base structure.

Initiatives by Industry

COGLA continued to welcome and encourage industry initiatives that promise to bring economic benefits to Canadians and Canadian companies in the oil and gas sector. Such initiatives include:

- The design and manufacture of a new generation of helicopter immersion suits by Shell and Albatross Manufacturing Limited. Albatross, a division of the Nova Scotian company Marine Equipment Limited, contracted the sale of 60 suits to Shell. Performance testing has shown that these suits may be the first to receive approval under the new standards established by the Canada General Standards Board.
- A water cannon testing program, conceived and run by Husky/Bow Valley, to evaluate the effectiveness of water cannons in controlling drift speed and the direction of growlers, bergy bits and small icebergs. Test results proved that ice

masses up to 45 000 tonnes can be controlled. Sixty-four successful unmanned PROD launches off the drilling unit *Bow Drill 3*, conducted by Husky/Bow Valley.

Task Force on Program Review

In response to recommendations of the Nielsen Task Force, the Minister of Energy, Mines and Resources, and the Minister of Regional Industrial Expansion are reviewing how best to cooperate on petroleum development matters that affect their departments. Examples of activities affected by this review are the Ocean Industry Development Centre and the Canada-Newfoundland Offshore Development Fund, both of which are relevant to the east coast offshore energy sector.



Ice research being conducted at Pond Inlet. Courtesy, N. Avery.

TOTAL 1986 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total* Work Force	Canadian	Per Cent Canadian
Mainland Territories (Yukon and N.W.T.)	583	583	100.0
Mackenzie Delta and Beaufort Sea	1 963	1 955	99.6
Arctic Islands and Eastern Arctic Offshore	237	237	100.0
Grand Banks and Labrador Sea	1 580	1 521	96.3
Nova Scotia Offshore	904	855	94.6
Total	5 267	5 151	97.8

*Calculated at peak levels of employment. Does not represent person-years of work.

TOTAL 1986 PETROLEUM EXPENDITURES ON FRONTIER LANDS

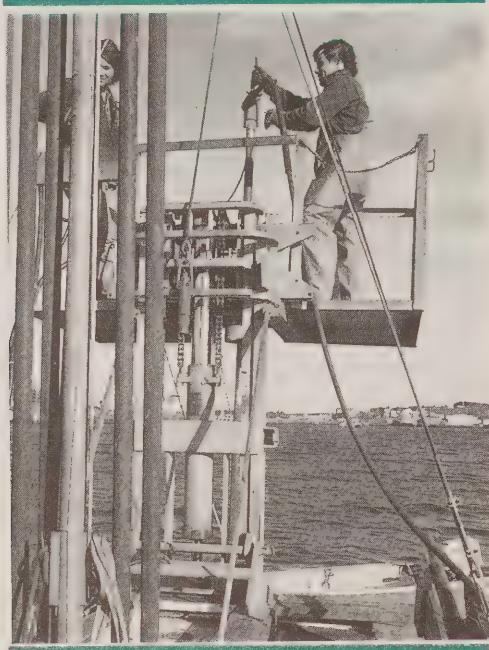
	Exploration* (\$M)	Development (\$M)	Production (\$M)	Total (\$M)	Canadian (\$M)	Per Cent** Canadian
Mainland Territories (Yukon and N.W.T.)	65.2	14.3	5.6	85.1	80.0	94.0
Mackenzie Delta and Beaufort Sea	406.1	0	0	406.1	324.9	80.0
Arctic Islands and Eastern Arctic Offshore	34.5	0	0.6	35.1	31.6	90.0
Grand Banks and Labrador Sea	351.1	0	0	351.1	207.2	59.0
Nova Scotia Offshore	177.7	0	0	177.7	101.3	57.0
Total	1 034.6	14.3	6.2	1 055.1	745.0	70.6

*Includes geophysical expenditures.

**Historical estimates.

Nonfuel Minerals

Offshore mineral exploration in Nova Scotia.



Regional Statistical Summary

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The Ocean Mining Division manages offshore nonfuel mineral interests on frontier lands that are the administrative responsibility of the Department of Energy, Mines and Resources. Their efforts include developing and disseminating information on the exploration and development of offshore nonfuel minerals, and establishing an attractive investment climate through implementation of simple, uniform regulations on offshore frontier lands in close cooperation with the coastal provinces. The division was transferred from COGLA headquarters to the Mineral Policy Sector of Energy, Mines and Resources in October 1986.

Frontier Lands

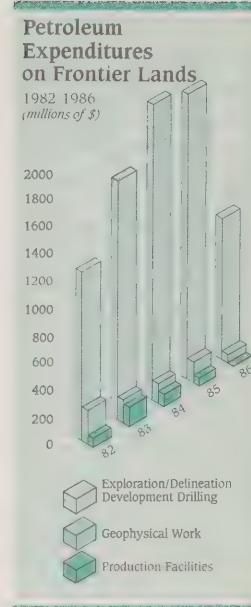
Statistical Summary

ACTIVITY STATUS ON FRONTIER LANDS	1982	1983	1984	1985	1986
Exploration Agreements Concluded	47	73	47	5	23
Wells Spudded	56	95	120	99	60
Metres Drilled	120 673	187 969	241 298	207 896	150 404
Wells Terminated	52	90	123	103	70
Significant Discoveries	9	5	11	15	14
Geophysical Programs Run	90	84	65	55	15
km Shot	117 803	106 749	63 817	57 091	11 001
Rig-Months	148	195	236	199	133

FRONTIER LANDS RESOURCE INVENTORY	OIL*		GAS	
	Discovered (millions of m³)	Potential	Discovered (billions of m³)	Potential
West Coast	0	50	0	270
Mainland Territories	51.0	95	23.3	312
Mackenzie Delta and Beaufort Sea	193.2	1 464	292.8	2 151
Arctic Islands and Eastern Arctic Offshore	65.7	873	416.4	3 156
Hudson Bay	0.0	127	0.0	88
Grand Banks and Labrador Sea	176.5	1 733	146.8	1 286
Nova Scotia Offshore	22.1	318	150.6	663
Total	508.5	4 660	1 029.9	7 926

*Includes condensate.

OIL AND GAS PRODUCTION ON FRONTIER LANDS	1982	1983	1984	1985	1986
<i>Oil Production (thousands of m³)</i>					
Norman Wells	173	169	175	949	1 411
Bent Horn	—	—	—	30	17
Amauligak	—	—	—	—	50
<i>Gas Production (millions of m³)</i>					
Pointed Mountain	206	181	194	226	205
Norman Wells	56	46	41	227	188



Mainland Territories

Statistical Summary



ACTIVITY STATUS	1982	1983	1984	1985	1986
Wells Spudded					
Exploratory/Delineation	0	4	18	15	14
Development	30	57	67	39	14
Total	30	61	85	54	28
Wells Terminated*					
Exploratory/Delineation	1	3	15	17	14
Development	28	57	69	38	14
Total	29	60	84	55	28
Metres Drilled	26 457	48 598	80 804	53 924	36 289
Exploratory/Delineation	2 461	3 608	28 769	23 968	24 401
Development	23 996	44 990	52 035	29 956	11 888
Geophysical Programs Run	8	12	20	17	7
km Shot	3 500	2 720	5 371	5 819	2 095

* In the mainland territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be re-entered in the following year for testing.

RESOURCES STATUS	1982	1983	1984	1985	1986**
Discovered Resources*					
Gas (billions of m³)	55.2	30.5	21.2	21.4	23.3
Oil (millions of m³)	44.5	44.2	52.3	51.0	51.0
Gas and Oil Production					
Pointed Mountain Gas (millions of m³)	206	181	194	226	205
Norman Wells Gas (millions of m³)	56	46	41	227	188
Norman Wells Oil (thousands of m³)	173	169	175	949	1 411

*As reported in previous years.

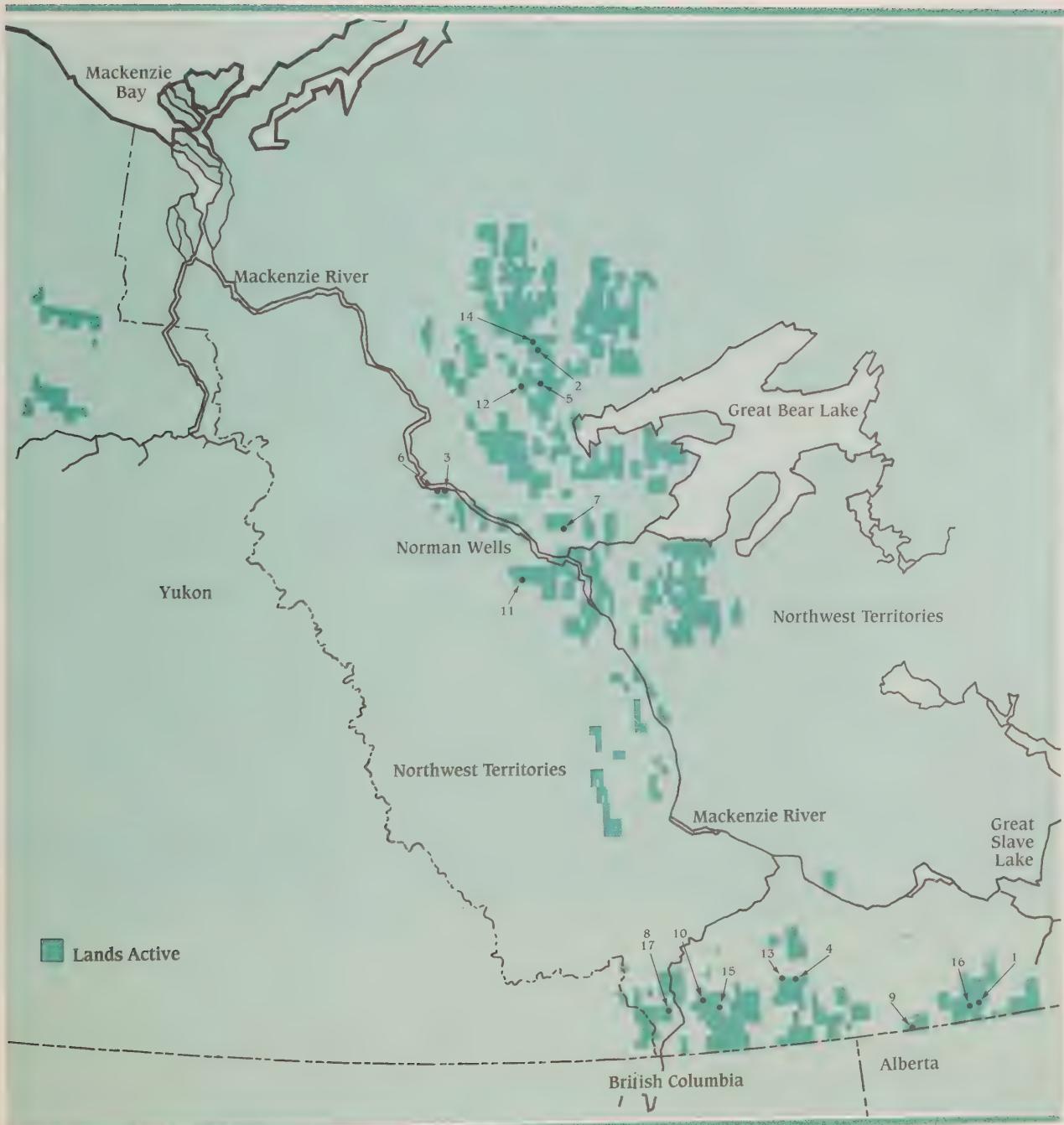
**Includes new discoveries and revisions to previous estimates.

BENEFITS STATUS	1982	1983	1984	1985	1986
Rigs Active	4	5	14	11	11*
Rig-Months	31	27	47	31	33
Money Spent (\$M)					
Geophysical	31.8	26.3	48.2	60.0	11.1
Exploratory/Delineation Drilling	21.0	12.5	49.5	69.3	54.1
Development Drilling	31.0	24.9	72.1	35.2	14.3
Production Facilities	133.7	159.8	86.1	23.5	5.6
Total	217.5	223.5	255.9	188.0	85.1

* One rig worked in both the mainland territories and Mackenzie Delta.

LAND STATUS	1982	1983	1984	1985	1986
Exploration Agreements (EAs) Concluded	0	27	7	0	0
Total EAs Active*	0	27	34	34	30
Lands Negotiated into EAs (millions of ha)	0	7.4	1.4	0	0
Lands Relinquished/Surrendered	N/A	N/A	0.1	3.1	3.3
Lands Active*	18.2	13.7	12.3	9.2	5.7

*Includes declared significant discovery areas.



Mainland Territories

Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (in m)
1	Paramount et al. Cameron Hills I-10	60°09'39"N 117°30'04"W	<i>Arnco 1</i> <i>Cactus 21</i> <i>Poncho 103</i>	85-02-19 85-04-02 86-01-31 86-03-07 86-03-16 86-03-31	Plugged & suspended, gas discovery	1 613
2	PCI Canterra Tweed Lake A-67 (Tweed Lake delineation)	66°56'12"N 125°56'19"W	<i>Atco/Equatak 76</i> <i>Roll'n 33</i>	85-11-13 85-12-23 86-02-05 86-03-09	Plugged & suspended, gas	1 347
3	AT&S Texaco Maida Creek 20-65	65°34'53"N 128°11'47"W	<i>Jade 5</i>	85-12-24 86-01-10	Plugged & abandoned	685
4	Sulpetro et al. Trout Lake F-08	60°37'15"N 121°01'24"W	<i>Canadrill 2</i>	86-01-13 86-02-15	Plugged & abandoned	1 755
5	PCI Canterra Nogha O-47	66°36'52"N 125°53'19"W	<i>Atco/Equatak 76</i>	86-01-13 86-02-17	Plugged & abandoned	1 416
6	AT&S Texaco Carcajou O-25	65°34'51"N 128°19'35"W	<i>Jade 5</i>	86-01-14 86-01-30	Plugged & abandoned	760
7	PCI K'alo B-62	65°11'03"N 125°27'05"W	<i>Bawden 52</i>	86-01-24 86-03-18	Plugged & abandoned	1 985
8	Northcor et al. Liard F-25	60°24'22"N 123°35'08"W	<i>Bawden 33</i>	86-01-25 86-08-05	Plugged & abandoned	3 146
9	Coho Home Silt Lake South 2G-21	60°00'28"N 118°49'23"W	<i>SDS 4</i>	86-02-02 86-02-11	Plugged & abandoned	410
10	NSM et al. Arrowhead D-50	60°29'15"N 122°54'13"W	<i>Spartan 7</i>	86-02-08 86-04-01	Plugged & abandoned	2 901
11	NSM et al. Blueberry Creek K-53	64°42'34"N 126°25'43"W	<i>Spartan 12</i>	86-02-08 86-04-04	Plugged & abandoned	2 965
12	PCI Canterra Bele O-35	66°34'58"N 126°21'32"W	<i>Jade 5</i>	86-02-14 86-04-02	Plugged & suspended, gas discovery	1 384
13	Sulpetro et al. Trout Lake J-29	60°38'34"N 121°19'14"W	<i>Canadrill 2</i>	86-02-23 86-03-20	Plugged & abandoned	1 663
14	PCI et al. N.W. Tweed Lake C-12 (Tweed Lake delineation)	67°01'02"N 126°03'03"W	<i>Atco/Equatak 76</i>	86-02-25 86-04-02	Plugged & abandoned	1 365
15	Northcor Celibeta B-25	60°24'13"N 122°34'20"W	<i>Badger 1</i>	86-03-09 86-03-20	Plugged & abandoned	810
16	Paramount et al. Cameron C-50	60°09'04"N 117°38'41"W	<i>Cactus 21</i>	86-03-09 86-03-26	Plugged & suspended, gas discovery	1 569
17	Northcor et al. Liard F-25A	60°24'22"N 123°35'08"W	<i>Bawden 33</i>	86-08-05	Testing, gas discovery	3 478

In 1986 abandonment operations were completed for the AT&S Carcajou D-05 well which had been suspended in 1985.

Mackenzie Delta and Beaufort Sea

Statistical Summary

ACTIVITY STATUS	1982	1983	1984	1985	1986
Wells Spudded Exploratory/Delineation	8	11	6	19	17
Wells Terminated* Exploratory/Delineation	8	4	12	16	24
Metres Drilled Exploratory/Delineation	23 580	37 381	31 682	48 370	48 016
Geophysical Programs Run	10	9	13	8	5
Km Shot	6 355	7 684	7 959	4 700	4 756

*In the Beaufort Sea, where operations from floating vessels are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

RESOURCES STATUS	1982	1983	1984	1985	1986**
Discovered Resources*					
Gas (billions of m³)	254.8	286.5	279.5	284.2	292.8
Oil (millions of m³)	111.3	133.0	130.4	183.1	193.2
Oil Production					
Amauligak (thousands of m³)	N/A	N/A	N/A	N/A	50.4

*As reported in previous years.

**Includes new discoveries and revisions to previous estimates.

BENEFITS STATUS	1982	1983	1984	1985	1986
Rigs Active	8	9	11	13	11*
Rig-Months	28	31	39	43	43
Money Spent (\$M)					
Geophysical	18.3	28.1	27.2	38.4	14.6
Exploratory/Delineation Drilling	600.0	629.8	786.4	760.5	391.5
Total	618.3	657.9	813.6	798.9	406.1

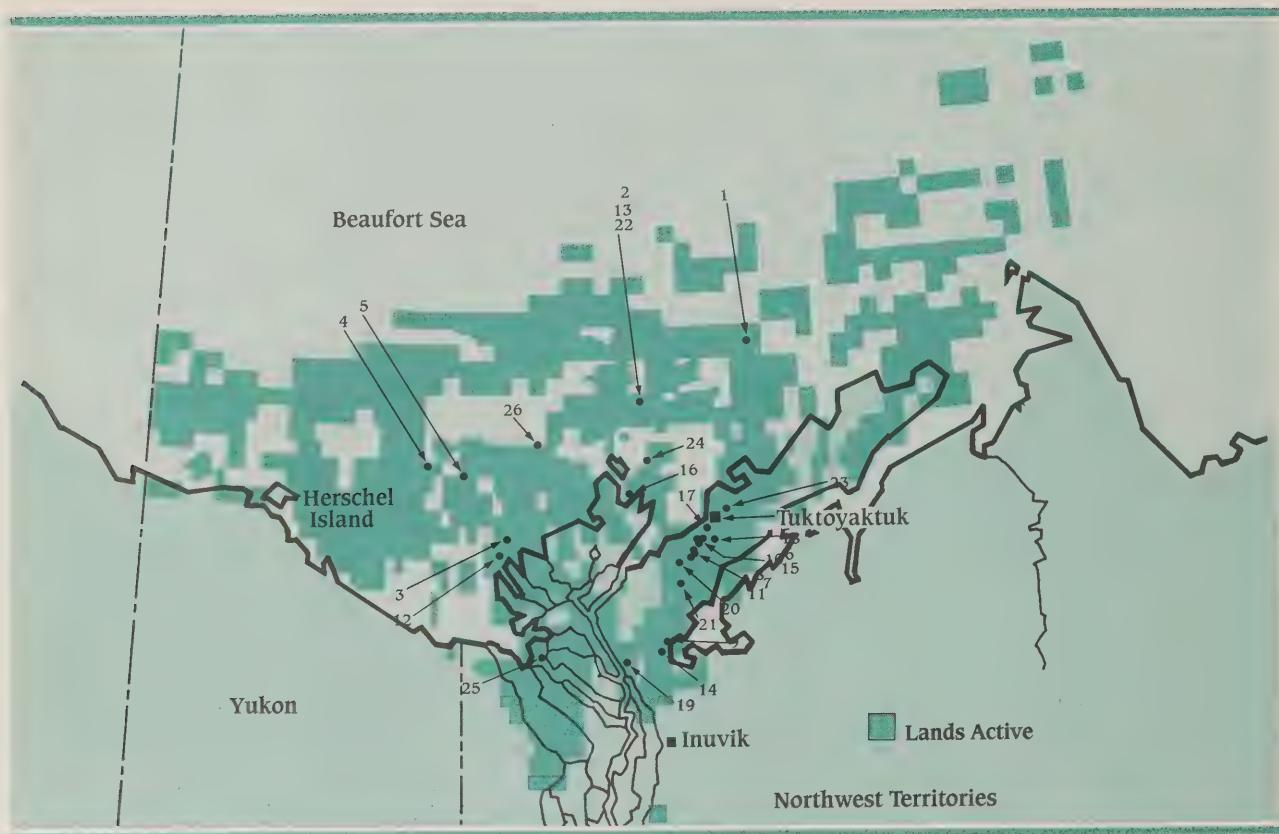
*One rig worked both in the Mackenzie Delta and in the Mainland Territories.

LAND STATUS	1982	1983	1984	1985	1986
Exploration Agreements (EAs) Concluded	6	9	9	0	0
Total EAs Active*	6	15	24	23	23
Lands Negotiated into EAs (millions of ha)	2.3	6.8	1.8	0	0
Lands Relinquished/Surrendered	N/A	N/A	0.3	1.6	3.1
Lands Active*	11.6	9.2	8.9	7.3	4.2

*Includes declared significant discovery areas.



Mackenzie Delta and Beaufort Sea



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (in m)
1	Dome et al. Havik B-41	70°20'11"N 132°13'05"W	<i>Explorer III</i> <i>Explorer II</i> <i>Explorer II</i> <i>Explorer I</i> <i>Explorer I</i>	83-07-17 83-07-29 83-09-13 83-09-29 84-06-29 84-10-06 85-08-22 85-09-30 86-07-21 86-08-24	Plugged & abandoned, oil discovery	4750
2	Gulf et al. Amauligak I-65 (Amauligak delineation)	70°04'40"N 133°48'16"W	<i>Molikpaq</i>	85-09-24 86-01-28	Plugged & abandoned, oil	4126
3	Esso Trillium et al. Adgo G-24 (Adgo delineation)	69°23'29"N 135°50'50"W	<i>Kenting 32</i>	85-10-07 86-01-07	Plugged & abandoned, gas	3087
4	Gulf et al. Aagnerk E-56	69°45'16"N 136°59'56"W	<i>Kulluk</i>	85-10-28 85-11-10 86-06-19 86-06-26	Plugged & abandoned	1100
5	Esso PCI Home et al. Minuk I-53	69°42'35"N 136°27'32"W	<i>Esso Rig 3</i>	85-11-27 86-05-02	Plugged & abandoned, gas discovery	3367

Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (in m)
6	Esso PCI Home et al. Tuktuk A-12 (Tuk Tertiary delineation)	69°21'01"N 133°02'59"W	Esso Rig 2	85-12-02 86-02-12	Plugged & abandoned, oil and gas	1790
7	Esso PCI Home et al. Tuk G-39 (Tuk Tertiary delineation)	69°18'22"N 133°08'43"W	Kenting 33 Roll'n Rig 12	85-12-05 86-01-06 86-01-10 86-01-24	Plugged & abandoned, oil	1797
8	Esso PCI Home et al. Tuk B-40 (Tuk Tertiary delineation)	69°19'14"N 133°08'18"W	Spartan 20 Roll'n Rig 12	85-12-08 86-01-09 86-01-25 86-02-11	Plugged & abandoned, oil	1800
9	Gulf et al. Parsons E-02	68°51'16"N 133°32'10"W	Bawden 1	85-12-22 86-01-23	Plugged & abandoned	1270
10	Esso PCI Home et al. Tuktuk H-22 (Tuk Tertiary delineation)	69°21'22"N 133°04'59"W	Kenting 33 Roll'n Rig 12	86-01-11 86-02-05 86-04-03 86-04-07	Plugged & suspended	1802
11	Esso PCI Home et al. Tuk G-48 (Tuk Tertiary delineation)	69°17'23"N 133°11'02"W	Spartan 20 Roll'n Rig 12	86-01-14 86-02-09 86-02-13 86-03-06	Plugged & abandoned, oil	1700
12	Chevron Trillium North Ellice L-39	69°18'43"N 135°54'60"W	Spartan 10	86-01-25 86-04-20	Plugged & abandoned	2047
13	Gulf et al. Amauligak I-65A	70°04'40"N 133°48'16"W	Molikpaq	86-01-28 86-03-20	Plugged & abandoned, oil discovery	4521
14	Gulf et al. Onigat K-49	68°48'40"N 133°41'47"W	Bawden 1	86-02-02 86-02-16	Plugged & abandoned	1423
15	Esso PCI Home et al. Tuktuk D-11 (Tuk Tertiary delineation)	69°20'12"N 133°04'41"W	Kenting 33 Roll'n Rig 12	86-02-07 86-03-02 86-03-09 86-04-01	Plugged & abandoned, oil and gas	1810
16	Esso PCI Home et al. Hansen G-07	69°36'20"N 134°01'12"W	Kenting 32 Spartan 20	86-02-10 86-04-11 86-04-25 86-06-12	Plugged & abandoned, oil and gas discovery	3276
17	Esso Home et al. Mayogiak N-34	69°23'60"N 132°54'03"W	Spartan 20	86-02-14 86-03-06	Plugged & abandoned	1722
18	Esso Home et al. Mayogiak G-12	69°21'17"N 132°48'39"W	Esso Rig 2	86-02-18 86-03-27	Plugged & abandoned	2829
19	Gulf et al. Ikhil K-35	68°44'44"N 134°09'16"W	Bawden 1	86-02-27 86-03-25	Plugged & abandoned, gas discovery	1540
20	Esso Home et al. Wagnark L-36	69°15'44"N 133°24'54"W	Kenting 33	86-03-08 86-04-25	Plugged & abandoned	2609
21	Esso Home et al. Nuna E-40	69°09'16"N 133°24'44"W	Spartan 20	86-03-14 86-03-31	Plugged & abandoned	1625
22	Gulf et al. Amauligak I-65B (Amauligak delineation)	70°04'40"N 133°48'16"W	Molikpaq	86-03-20 86-09-19	Plugged & abandoned, oil and gas	5402
23	Esso Home et al. Atertak K-31	69°30'34"N 132°39'07"W	Esso Rig 2	86-04-08 86-05-12	Plugged & abandoned	3134
24	Esso PCI Home et al. Arnak K-06	69°45'40"N 133°46'21"W	Kenting 32	86-04-27 86-08-12	Plugged & abandoned, oil and gas discovery	4645
25	Shell et al. Unak L-28	68°47'39"N 135°22'06"W	Atco 47	86-08-10 86-12-13	Plugged & abandoned, gas discovery	3259
26	Esso Home et al. Kaubvik I-43	69°52'33"N 135°25'21"W	SCRI Esso Rig 3	86-10-22	Testing	3323

Arctic Islands and Eastern Arctic Offshore

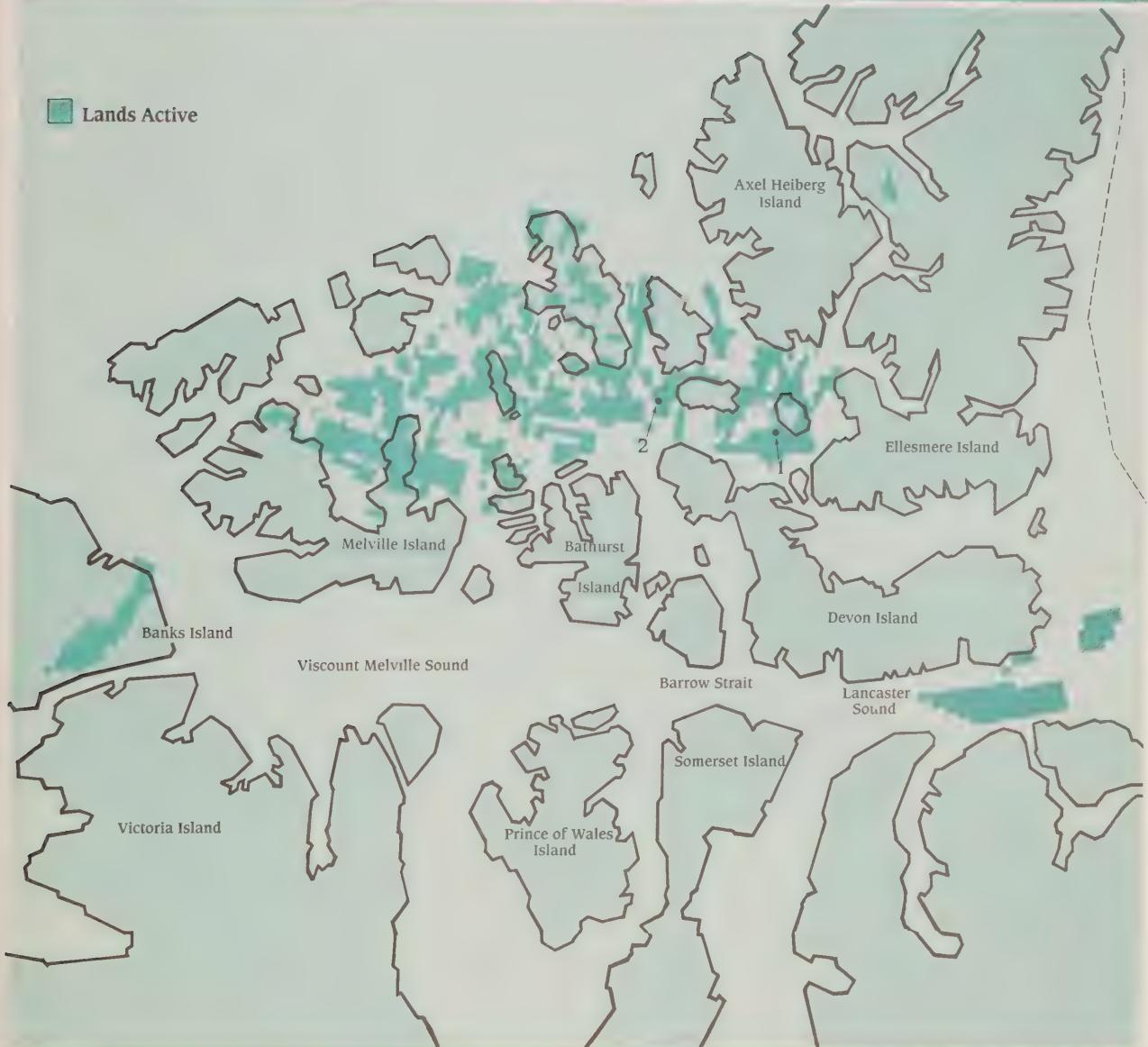
Statistical Summary



ACTIVITY STATUS	1982	1983	1984	1985	1986
Wells Spudded Exploratory/Delineation	7	4	3	3	2
Wells Terminated Exploratory/Delineation	6	5	4	3	2
Metres Drilled Exploratory/Delineation	18 987	12 087	11 007	6 185	4 940
Geophysical Programs Run	6	2	1	0	0
km Shot	5 126	1 142	601	0	0
RESOURCES STATUS	1982	1983	1984	1985	1986**
Discovered Resources*					
Gas (billions of m³)	379.5	372.2	390.1	415.7	416.4
Oil (millions of m³)	47.7	76.1	49.3	65.7	65.7
Oil Production					
Bent Horn (thousands of m³)	N/A	N/A	N/A	30	17.1
*As reported in previous years.					
**Includes revisions to previous estimates.					
BENEFITS STATUS	1982	1983	1984	1985	1986
Rigs Active	6	4	4	3	2
Rig-Months	19	17	13	9	4
Money Spent (\$M)					
Geophysical	15.6	6.2	4.6	0.2	0
Exploratory/Delineation Drilling	122.5	67.8	64.0	48.0	34.5
Production Facilities	0	0	0	7.8	0.6
Total	138.1	74.0	68.6	56.0	35.1
LAND STATUS	1982	1983	1984	1985	1986
Exploration Agreements (EAs) Concluded	21	0	3	1	1
Total EAs Active*	21	21	24	25	21
Lands Negotiated into EAs (millions of ha)	24.5	0	1.5	0.7	0.9
Lands Relinquished/Surrendered	N/A	N/A	0.9	1.4	8.9
Lands Active*	24.5	17.3	15.8	15.1	7.5

*Includes declared significant discovery areas.

 Lands Active



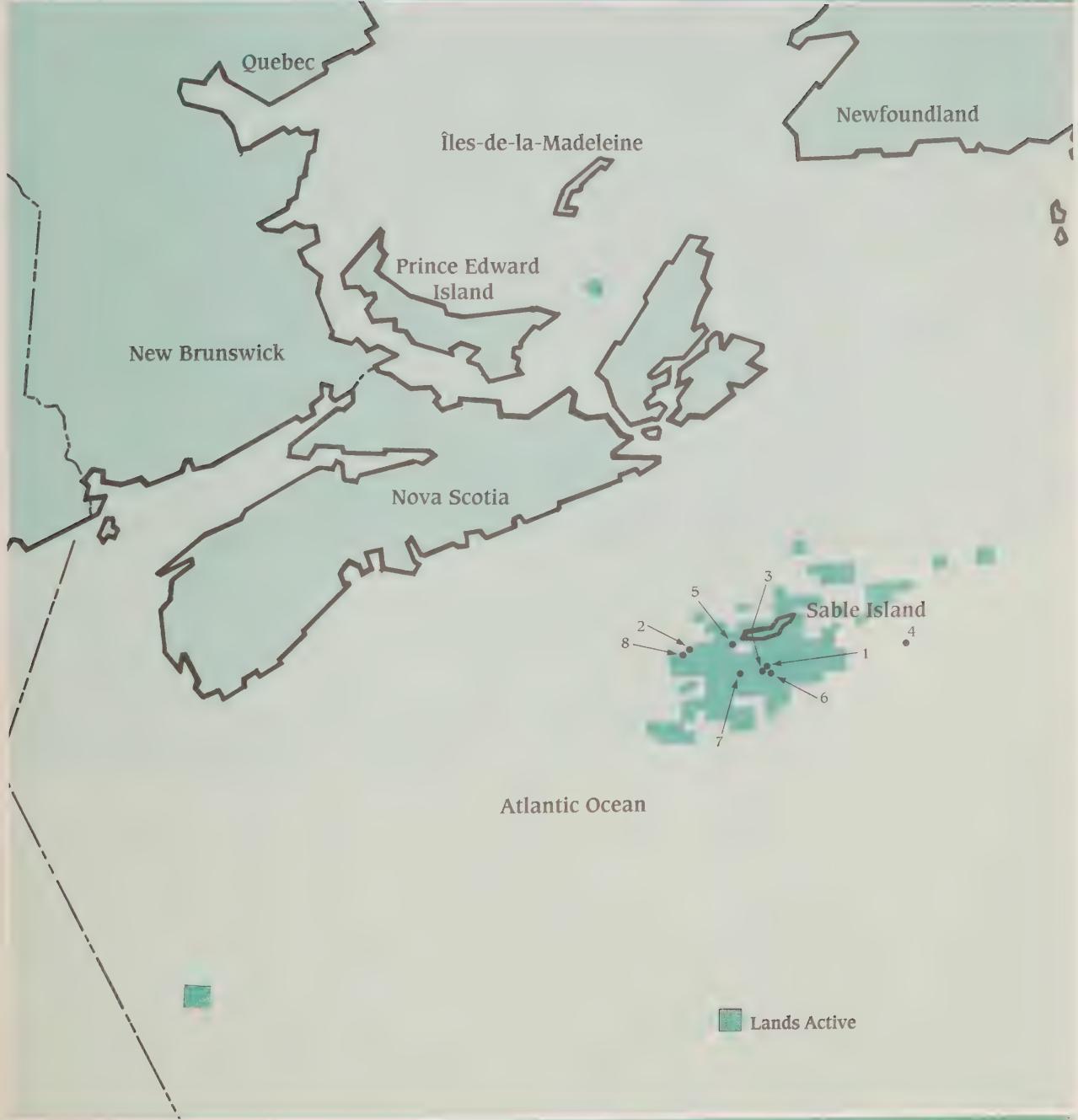
Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Terminated	Status, Results	Total Depth (in m)
1	Panarctic et al. N. Buckingham L-71	77°10'42"N 91°29'28"W	Panarctic Rig A	86-01-28 86-04-04	Plugged & abandoned	2800
2	Panarctic et al. W. Cornwall N-49	77°28'53"N 97°17'32"W	Panarctic Rig C	86-02-12 86-04-05	Plugged & abandoned	2140

Nova Scotia Offshore

(includes the Gulf of St. Lawrence)
Statistical Summary



ACTIVITY STATUS	1982	1983	1984	1985	1986
Wells Spudded Exploratory/Delineation	6	12	14	10	6
Wells Terminated Exploratory/Delineation	5	11	13	14	8
Metres Drilled Exploratory/Delineation	28 544	60 088	71 046	47 064	29 744
Geophysical Programs Run	32	38	17	14	2
km Shot	35 923	38 495	21 587	26 814	613
RESOURCES STATUS	1982	1983	1984	1985	1986**
Discovered Resources*					
Gas (billions of m³)	79.3	108.7	122.6	127.4	150.6
Oil (millions of m³)	8.2	13.7	16.7	20.0	22.1
* As reported in previous years.					
** Includes new discoveries and revisions to previous estimates.					
BENEFITS STATUS	1982	1983	1984	1985	1986
Rigs Active	6	9	10	8	5*
Rig-Months	39	72	83	50	22
Money Spent (\$M)					
Geophysical Exploratory/Delineation Drilling	43.8	50.5	23.2	29.2	0.9
Exploratory/Delineation Drilling	220.0	579.4	594.7	452.0	176.8
Total	263.8	629.9	617.9	481.2	177.7
* Three rigs worked off both Nova Scotia and Newfoundland.					
LAND STATUS	1982	1983	1984	1985	1986
Exploration Agreements (EAs) Concluded	20	5	15	2	13
Total EAs Active *	20	25	30	28	15
Lands Negotiated into EAs (millions of ha)	9.0	0.5	10.5	0.9	1.7
Lands Relinquished/Surrendered	N/A	1.6	8.5	2.8	3.2
Lands Active*	20.2	20.0	6.3	4.2	1.1
* Includes declared significant discovery areas.					



Nova Scotia Offshore (includes the Gulf of St. Lawrence) Statistical Summary

Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Terminated	Status, Results	Total Depth (in m)
1	Shell PCI et al. North Triumph G-43	43°42'19"N 59°51'23"W	Sedco 709	85-09-26 86-01-31	Plugged & abandoned, gas discovery	4504
2	Petro-Canada et al. Cohasset A-52 (Cohasset delineation)	43°51'08"N 60°37'43"W	Rowan Gorilla I	85-12-20 86-03-26	Plugged & suspended, oil	2847
3	Shell PCI et al. North Triumph B-52 (North Triumph delineation)	43°41'02"N 59°52'57"W	John Shaw	86-01-24 86-03-26	Plugged & abandoned, gas	3960
4	Shell et al. Tantallon M-41	43°50'56"W 58°22'24"W	Sedco 709	86-02-15 86-04-17	Plugged & abandoned	5602
5	Mobil et al. Thebaud C-74 (Thebaud delineation)	43°53'05"N 60°11'36"W	Rowan Gorilla I	86-03-29 86-09-25	Plugged & abandoned, gas	5150
6	HBV et al. West Chebucto K-20	43°39'45"N 59°47'33"W	Bow Drill 2	86-04-05 86-08-11	Plugged & abandoned	5369
7	Shell PCI et al. Glenelg N-49 (Glenelg delineation)	43°38'59"N 60°07'02"W	Vinland	86-06-01 86-08-04	Plugged & abandoned, gas	4040
8	Shell PCI et al. Panuke B-90	43°49'12"N 60°42'35"W	Vinland	86-08-06 86-09-23	Plugged & abandoned, oil discovery	3445

In 1986 abandonment operations were completed for the following wells which had been suspended in previous years:

Mobil Tetco Thebaud P-84	Mobil Tetco Sable Island 1AH-58	Mobil Tetco Sable Island 4H-58
Mobil Tetco Sable Island E-48	Mobil Tetco Sable Island 2H-58	Mobil Tetco Sable Island 5H-58
Mobil Tetco Sable Island O-47	Mobil Tetco Sable Island 3H-58	Mobil Tetco Sable Island 6H-58

Appendix I

Newfoundland Offshore

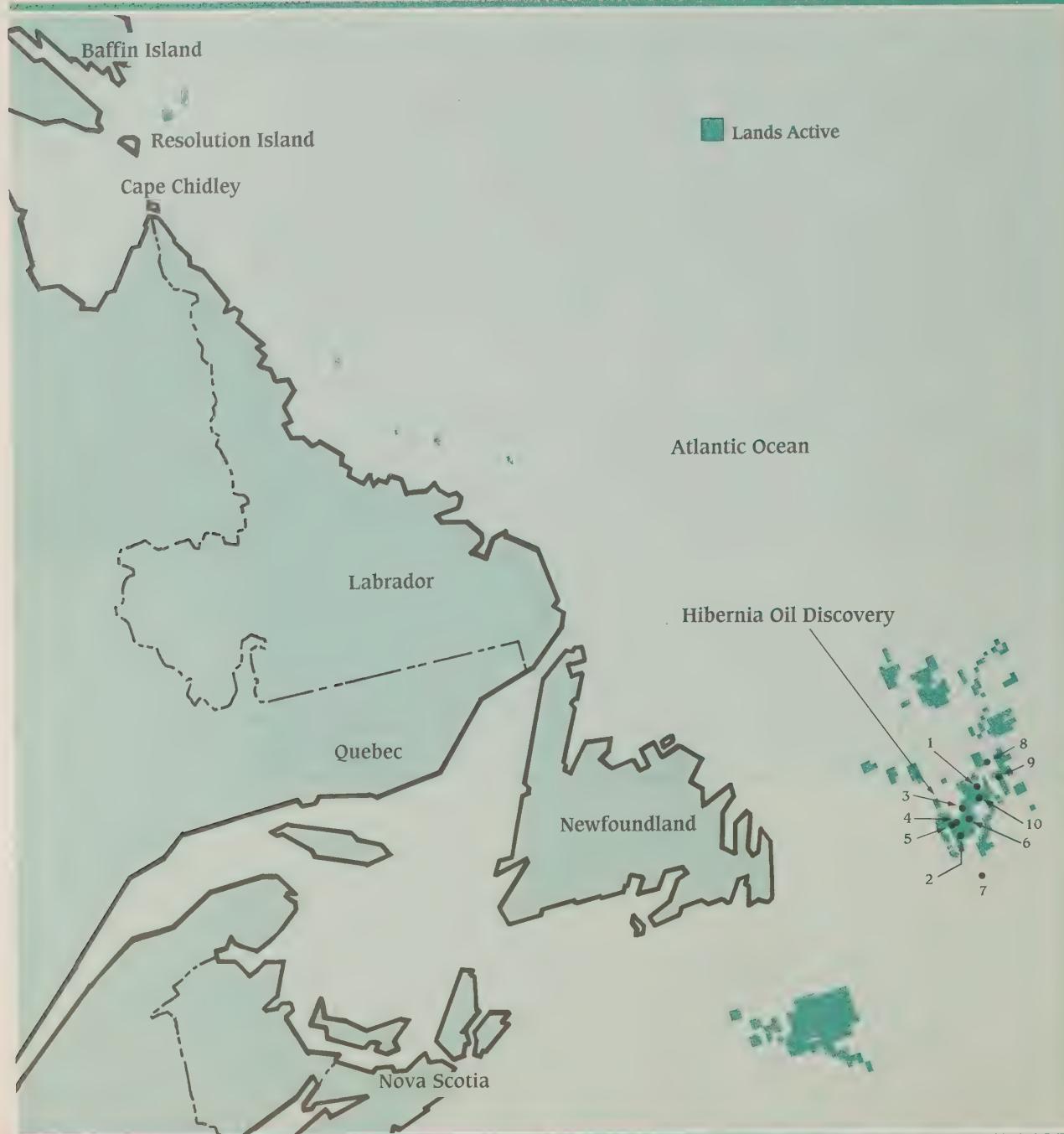
(1986 data provided by the Canada-Newfoundland Offshore Petroleum Board)
Statistical Summary



ACTIVITY STATUS	1982	1983	1984	1985	1986
Wells Spudded Exploratory/Delineation	5	7	12	11	7
Wells Terminated Exploratory/Delineation	4	10	10	13	8
Metres Drilled Exploratory/Delineation	23 105	29 815	46 759	49 098	31 415
Geophysical Programs Run	33	21	12	16	1
km Shot	61 411	48 261	27 808	19 758	3 537
RESOURCES STATUS	1982	1983	1984	1985	1986**
Discovered Resources*					
Gas (billions of m³)	124.0	126.7	145.2	152.4	146.8
Oil (millions of m³)	257.5	211.5	159.9	185.1	176.5
*As reported in previous years.					
**Includes new discoveries and revisions to previous estimates.					
BENEFITS STATUS	1982	1983	1984	1985	1986
Rigs Active	7	9	9	8	6*
Rig-Months	31	48	54	63	31
Money Spent (\$M)					
Geophysical	71.6	57.4	27.8	27.3	4.1
Exploratory/Delineation Drilling	210.0	436.9	485.9	630.0	347.0
Total	281.6	494.3	513.7	657.3	351.1
*Three rigs worked off both Newfoundland and Nova Scotia.					
LAND STATUS	1982	1983	1984	1985	1986
Exploration Agreements (EAs)					
Concluded	0	32	13	0	9
Total EAs Active*	0	32	41	38	27
Lands Negotiated into EAs (millions of ha)	0	10.3	6.0	0	1.5
Lands Relinquished/Surrendered	N/A	N/A	8.6	10.9	9.2
Lands Active*	29.1	24.6	22.0	11.9	3.4
*Includes declared significant discovery areas.					

Newfoundland Offshore

(1986 data provided by the Canada-Newfoundland Offshore Petroleum Board)
Statistical Summary



Map No.	Name of Well	Latitude Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (in m)
1	HBV et al. Panther P-52	47°01'53"N 47°37'44"W	Sedco 706 Bow Drill 3	85-01-10 85-01-22 85-11-06 86-01-30	Plugged & abandoned	4203
2	Petro-Canada et al. Terra Nova I-97 (Terra Nova delineation)	46°26'43"N 48°28'49"W	Vinland	85-11-26 86-02-26	Plugged & suspended, oil	3465
3	HBV et al. Whiterose L-61 (Whiterose delineation)	46°50'34"N 48°10'28"W	Bow Drill 2 Bow Drill 2 Bow Drill 3	85-12-18 86-02-13 86-03-06 86-03-26 86-09-14 86-10-02	Plugged & abandoned, gas	3340
4	HBV et al. North Ben Nevis M-61 (North Ben Nevis delineation)	46°40'54"N 48°25'19"W	Sedco 710	86-01-09 86-03-31	Plugged & suspended	3250
5	Gulf et al. Mara E-30	46°39'30"N 48°34'28"W	Bow Drill 1	86-01-13 86-02-15	Plugged & abandoned	2100
6	HBV et al. Fortune G-57	46°36'19"N 48°08'02"W	Bow Drill 3	86-02-05 86-09-09	Plugged & abandoned, oil discovery	4995
7	Canterra PCI et al. St. George J-55	45°44'40"N 48°23'05"W	Vinland	86-04-09 86-05-27	Plugged & abandoned	4100
8	Petro-Canada Lancaster F-70	47°19'23"N 47°09'45"W	Sedco 710	86-04-23 86-11-04	Plugged & abandoned	5701
9	Esso Parex et al. Kyle L-11	47°00'37"N 47°02'49"W	Sedco 709	86-04-26 86-08-05	Plugged & abandoned	4200
10	HBV et al. Golconda C-64	46°53'12"N 47°39'57"W	Bow Drill 3	86-10-05	Drilling	3840

In 1986 abandonment operations were completed for Petro-Canada et al. Terra Nova K-08 well which had been suspended in 1984.

Glossary of Terms

Abandoned Well: any well that has been permanently plugged.

Call for Nominations: a notice inviting interested parties to nominate tracts of lands for potential inclusion in a Call for Proposals.

Call for Proposals: a notice published in the *Canada Gazette* or other publication, whereby the Minister calls for the submission of bids in relation to Crown reserve land.

Completed Well: a well that has been drilled and equipped so that it is capable of producing oil or gas.

Condensate: hydrocarbons occurring in gaseous form at subsurface temperatures and pressures, but which condense to the liquid state at surface temperature and pressure.

Cubic Metre of Gas: equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.

Cubic Metre of Oil: equivalent to 6.2898 American stock tank barrels.

Delineation Well: a well drilled as a follow-up, or extension to a significant discovery on the same geological feature, the purpose of which is to determine the extent and commercial potential of the oil or gas accumulation encountered in the discovery well.

Development Plan: a plan describing the wells and other facilities proposed to develop a field.

Development Well: a well drilled as part of a development plan.

Drillstem Test: a test involving temporary completion of a well to evaluate fluid flow rates and to collect fluid samples.

Dry Hole: a well that has failed to find significant amounts of oil or gas.

Exploration Licence: a licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a Production Licence subject to compliance with the other provisions of the Canada Petroleum Resources Act (formerly Exploration Agreement).

Exploratory Well: a well drilled on a geological feature on which a significant discovery has not previously been made (synonymous with wildcat well).

Extended Flow Test: a prolonged drillstem test.

Gas Pay Section: the formation or zone containing gas.

Gas-Prone: having a high probability of encountering a gas-bearing formation in any given area.

Geopressure: abnormally high pressure exerted by subsurface fluids.

Gravity Base Structure: a structure that relies on gravity to maintain its stability on the seabed.

Hectare: 10 000 square metres (equivalent to 2.47 acres).

Hydrocarbon: a naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.

Ice Platform: a specially thickened platform made of ice which supports a conventional land drilling rig thereby enabling a well to be drilled in deep water between Arctic land masses.

Infill Drilling: drilling wells between existing wells to better exploit the reservoir.

Miscible Flooding: method of enhanced recovery in which various hydrocarbon solvents or gases are injected into the reservoir to help displace oil from the reservoir rock.

Mobile Arctic Caisson: an annular steel caisson, with deck dimensions of 75 m x 73 m, which is designed to be set down on a subsea berm (better known as the *Motikpaq*).

MODU (mobile offshore drilling unit): any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.

Overpressuring: subsurface fluid pressure greater than the normal hydrostatic pressure.

Sacrificial Beach Island: an island made of sand by dredging or other means, and which has long, sloping beaches to combat erosion by waves.

Semisubmersible: a MODU which is stabilized by ballasting its pontoons (base) and columns to a predetermined depth during drilling operations. Used extensively in the rough seas.

Significant Discovery: a discovery indicated by the first well on a geological feature that demonstrates the existence of hydrocarbons and suggests the existence of an accumulation that has potential for sustained production.

Suspended Well: a well in which drilling or production operations have temporarily ceased.

Terminated Well: a well that has reached total depth and has been abandoned, completed or suspended.

COGLA Offices

Region	Mailing Address	Street Address	Telephone	Telex	Telecopier
Headquarters	15th Floor, Tower B 355 River Road Ottawa, Ontario K1A 0E4	14th Floor, Tower B 355 River Road Vanier, Ontario	(613) 993-3760	053-4366	993-9897
Maritimes	2000 Barrington Street Suite 102 Halifax, Nova Scotia B3J 3K1	Cogswell Tower, Scotia Square 2000 Barrington Street Suite 102 Halifax, Nova Scotia	(902) 426-8570	019-23632	426-5253
	COGLA Laboratory P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2	Bedford Institute of Oceanography, Dartmouth, Nova Scotia	(902) 426-3179 (902) 426-2525	-	-
Northwest Territories	P.O. Box 1500 Yellowknife, N.W.T. X1A 2R3	Bellanca Building 4914-50th Street 6th Floor Yellowknife, N.W.T.	(403) 920-8175	034-45570	873-8707
	P.O. Box 2020 Inuvik, N.W.T. XOE 0TO		(403) 979-3006	034-44541	979-2090
Western	P.O. Box 2638 Station M Calgary, Alberta T2P 3C1	Room 482 220-4th Avenue, SE Calgary, Alberta	(403) 231-5631	-	-

Canada



Energy, Mines and
Resources Canada
Indian and Northern
Affairs Canada

Énergie, Mines et
Ressources Canada
Affaires indiennes
et du Nord Canada

CA 1
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The Canada Oil and Gas Lands Administration



Annual
Report
1987

Corporate Profile

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a Memorandum of Understanding between the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development.

COGLA is the federal government's principal contact with the oil and gas industry in matters relating to the regulation of oil and gas activity on Canada's frontier lands. These lands include the Yukon Territory, the Northwest Territories, Hudson Bay and most of the country's offshore areas. The Canada-Newfoundland Offshore Petroleum Board has had operational responsibility for the Newfoundland and Labrador offshore since January 1986. A new Canada - Nova Scotia Offshore Petroleum Board with operational responsibilities in the Nova Scotia offshore will be established following passage of legislation implementing the Canada - Nova Scotia Accord.

COGLA's prime responsibility is to regulate the exploration for and the development and production of oil and gas on Canada's frontier lands in a manner that ensures safety of the worker, effective resource conser-

vation, protection of the environment, and full and fair access by Canadians to the benefits arising from activities related to the development of hydrocarbon resources.

COGLA has five branches:

- The Rights Management Branch
- The Engineering Branch
- The Resource Evaluation Branch
- The Environmental Protection Branch
- The Policy Analysis and Coordination Branch

COGLA's regional office in Halifax had operational responsibility for the Nova Scotia offshore throughout 1987; the Yellowknife office had similar responsibilities in the North. These offices issue authorizations to drill wells, conduct regular inspections and monitor the engineering, geological and environmental aspects of all oil and gas industry operations, as well as ensure compliance with benefits plans.



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Message from the Minister of Energy, Mines and Resources, the Honourable Marcel Masse



Minister Marcel Masse

I have the honor of submitting to Parliament the sixth annual report of the Canada Oil and Gas Lands Administration (COGLA), the organization formed in 1981 to regulate petroleum activities on our frontier lands. Canadians recognize that this government has improved the overall approach to regulation of the energy industry, and COGLA has been a key player in this process.

The Frontier Energy Policy statement of October 1985 and the Canada Petroleum Resources Act, which became law in 1987, freed the oil and gas industry from excessive government intervention. Geology and economics have become the principal determinants of industry's decisions on exploration and development of Canada's frontier oil and gas resources.

On the East Coast, shared management arrangements with the provinces in the offshore have brought stability to industry decision making. During 1987, the Canada-Newfoundland Offshore Petroleum Board, a joint federal-provincial body established under the Atlantic Accord, completed its first full year of operation. Legislation to implement the Canada - Nova Scotia Accord and to establish a Canada - Nova Scotia Offshore Petroleum Board was introduced in the House of Commons and was being considered at the committee stage at year-end. The provincial bill to implement the accord was passed by the Nova Scotia Legislative Assembly in May.

On the West Coast, discussions took place with the Government of British Columbia concerning potential approaches to shared management in the offshore. The Government of Canada also considered approaches to a possible northern oil and gas accord.

One of COGLA's key responsibilities is to ensure that petroleum exploration, development and production on Canada's frontier lands are carried out with full regard for the safety of workers and the protection of the environment. COGLA continues to initiate research projects to increase the safety of petroleum workers in offshore and onshore frontier lands.

COGLA is also undertaking a major review of the Oil and Gas Production and Conservation Act in collaboration with the provinces, the Canada-Newfoundland Offshore Petroleum Board, government departments and industry to implement, through amendments to legislation, the remaining recommendations on offshore safety made by the Hickman royal commission on the *Ocean Ranger*.

The Government of Canada took a major step in 1987 to improve the long-term prospects for frontier oil and gas development. The Canada-U.S. Free Trade Agreement promises to open new markets to Canadian oil and gas resources. The agreement ensures that U.S. markets will remain open to Canadian energy exports and unimpeded by discriminatory restrictions on the part of either government. This more stable trading environment will enhance investor confidence and ensure that more investment capital will be available to assist in the development of large-scale petroleum projects on the frontier lands.

In my capacity as Minister of Energy I have asked my department to review existing laws and regulations to ensure that they fully take into account environmental considerations. COGLA's ongoing participation in this review process ensures that environmental protection remains a priority in the exploration and development of our frontier petroleum resources.

Industry is responding to the direction provided by this government's energy policies. The world oil price stabilized in 1987, and operators undertook delineation drilling at the sites of major discoveries off the East Coast and north of the 60th parallel. There was also the success of projects such as the delineation of the Panuke oil discovery carried out by Petro-Canada and Nova Scotia Resources (Ventures) Limited. Production testing of the Panuke F-99 well led to the first shipment of oil from the Nova Scotia offshore and confirmed that petroleum can be produced from this region. In the Newfoundland offshore, the successful delineation of the Terra Nova discovery by Petro-Canada signals the possibility of early production from this oil field.

I am looking forward to the year ahead, when the work under way at these sites, and other discoveries on Canada's frontier lands, such as the Amauligak field in the Beaufort Sea, continue to contribute to the Canadian economy and to the prosperity of all Canadians.

A handwritten signature in black ink, appearing to read "Marcel Masse".

Message from the Minister of Indian Affairs and Northern Development, the Honourable Bill McKnight

I am pleased to join my colleague, the Honourable Marcel Masse, Minister of Energy, Mines and Resources, in submitting to Parliament the sixth annual report on the administration of Canada's frontier energy resources.

A cornerstone of this government's Frontier Energy Policy is a commitment to shared management arrangements with Canada's coastal provinces and territories for the management of frontier oil and gas resources. The policy also recognizes the importance of oil and gas to the political evolution of the North. Unlike other frontier jurisdictions, oil and gas areas in the North are on land as well as offshore and most of the area is covered by unsettled land claims.

This government's Political and Economic Framework for the North is a confirmation of our commitment to the political evolution of responsible and independent governments in the North, within the Canadian federation. A cornerstone of the government's policy for the North is a commitment to transfer to territorial governments management and administration for programs which, in the rest of Canada, are provincial responsibilities.

During the past two years, the Department of Indian Affairs and Northern Development has had extensive discussions with territorial governments, northern aboriginal groups and industry to determine how best to apply the Frontier Energy Policy in a way that accommodates the legitimate political aspirations of territorial governments and at the same time provides a predictable and stable political climate necessary to encourage development of the North's energy resources. A northern energy accord, providing for the shared management of northern oil and gas resources, is a priority. We will be working together to create an accord that will be fair to northerners and all Canadians, while seeking to protect the interests of native people.

I was pleased to bring to a successful conclusion the process leading to the first new exploration rights granted in the Mackenzie Valley in more than 15 years. The signing of this unique exploration agreement with Chevron Canada Resources for exploration rights in the Fort Good Hope area, however, should not be considered a precedent for future rights issuances. It is the last exploration agreement considered under the old Canada Oil and Gas Act. Subsequent rights issuance will be governed under the new Canada Petroleum Resources Act.

The Canada Petroleum Resources Act was proclaimed in February, creating a simplified regulatory framework for the northern oil and gas industry. The new act also provides the flexibility to ensure that the North as a whole will benefit from the activities created by the industry.

While the number of exploratory wells drilled in northern frontier lands decreased dramatically from forty in 1986 to six in the past year, with one significant gas discovery in the southern part of the Northwest Territories, the outlook for northern oil and gas exploration and development is decidedly optimistic.

One of the year's most encouraging developments was Gulf Canada's decision to return to the Amauligak structure in the Beaufort Sea for further delineation and testing. The return to Amauligak was made possible by the co-operative efforts of industry, governments and northerners. While the current program has given the local economy a much-needed boost, prospects are exciting and signal a return to optimism in the future of Beaufort Sea exploration and development.

In the High Arctic, Panarctic has expanded its storage facilities by almost half and shipped two tanker loads of oil from its Bent Horn field. Small shipments of oil were dropped off at Resolute and at the Polaris mine to test the feasibility of supplying northern customers directly with northern resources.

I said in my message last year that I was confident that a more favorable climate for northern oil and gas would prevail. The past year has strengthened that confidence. With the policies that this government has put in place, with the free trade agreement with the United States expanding the market for northern energy resources and with increased cooperation between the federal and territorial governments, I believe that we are moving into a more favorable climate for northern oil and gas exploration and development.

There is no question that for the foreseeable future, oil and gas will remain extremely important to the North's economy. We must work together, the federal and territorial governments, the oil and gas industry and northerners, to ensure that oil and gas exploration and development activity is sustained in the North and that it continues for the benefit of all northerners, indeed, of all Canadians.



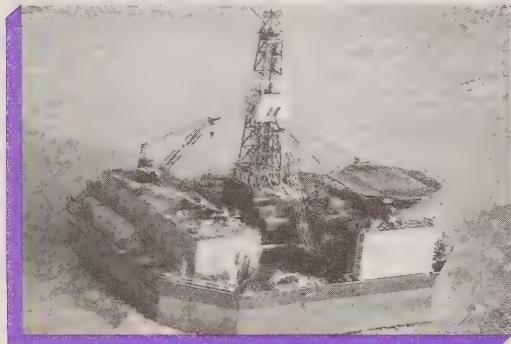
Minister Bill McKnight

A handwritten signature in cursive script that reads "Bill McKnight". The signature is fluid and appears to be written in black ink on a plain white background.

Canada's Frontier Lands

Loading the tanker MV Arctic at Panarctic's Bent Horn facility.
Courtesy F.R. Engelhardt.

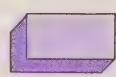
The Molikpaq, Gulf's mobile arctic caisson, drilling at Amauligak in the Beaufort Sea.



COGLA geologist participating in a field investigation near Norman Wells. Courtesy T. Bird.



Coastline of South Moresby Island, B.C. Courtesy D. Hardie.



Area administered by the Minister of
Energy, Mines and Resources



Area administered by the Minister of
Indian Affairs and Northern Development



Recovery of boom during experimental oil spill exercise offshore Newfoundland.
Courtesy Canada-Newfoundland Offshore Petroleum Board.



Bow Drill 3 on location at Husky/Bow Valley et al. Whiterose E-09 on the Grand Banks. Courtesy Canada-Newfoundland Offshore Petroleum Board.



Loading tanker during Petro-Canada et al. Panuke F-99 test.
Courtesy Petro-Canada Resources Inc.



A Word from COGLA's Administrator, Maurice Taschereau



Mr. Maurice Taschereau

A continuing but reduced level of exploration activity took place on Canada's frontier lands in 1987. Uncertain oil prices and the difficulty of predicting the future compelled the industry to concentrate its efforts on delineating existing discoveries. This trend is expected to continue in 1988.

Amauligak is an exciting prospect for future development in the North. COGLA's role is to make the regulatory process as effective as possible, so that oil can be produced from this splendid find in a sound and environmentally safe manner.

There were other encouraging signs during the past year. On the east coast, for example, the Terra Nova and Whiterose oil fields were being delineated and on the Scotian Shelf an extended flow test of the Panuke reservoir resulted in the first shipment of oil from the Nova Scotia offshore. Panarctic continued to develop northern markets for northern oil. Shipments of Bent Horn oil were delivered to Resolute and the Polaris mine to test the feasibility of using the oil directly in the North without first refining it in southern Canada.

The Canada Petroleum Resources Act (CPRA), proclaimed in February, simplified rights issuance on the frontier lands. The implementing legislation for both the Atlantic and Nova Scotia accords incorporates CPRA. The regulations under the accords are consistent with those applying throughout the rest of Canada's frontier lands. So, although there are separate joint federal-provincial management regimes for oil and gas activity off Canada's east coast, there is a consistent regulatory regime across all frontier areas.

The Canada-Newfoundland Atlantic Accord Implementation Acts were proclaimed by both governments in April. The Canada-Newfoundland Offshore Petroleum Board has in effect been operating for two years; the past year was especially busy. The Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation Acts are expected to be proclaimed in 1988.

This will continue the joint management and revenue sharing of petroleum resources off Nova Scotia as well as create a new independent board, the Canada - Nova Scotia Offshore Petroleum Board, to manage activities on behalf of both governments.

Negotiations began in 1987 with the Government of British Columbia on an accord for the Pacific offshore region.

As activity on the frontier lands decreased, COGLA trimmed its staff to the minimum needed to carry out its duties and responsibilities properly. We have used this lean period to put legislation, regulations and guidelines in place. This has proved to be a demanding job requiring close cooperation with, and input from, the provincial and territorial governments, the new boards, other federal departments and industry. Much has been accomplished in 1987 and more remains to be done. We look forward to having a fair, consistent regulatory regime well established as we move into the next phase of exploration and development activity on Canada's frontier lands.

I would like to take this opportunity to express my thanks to the staff of COGLA for their dedication and diligence. I know they will continue to fulfil their duties and responsibilities efficiently and effectively, as they have in the past.

A handwritten signature in black ink, appearing to read "Maurice Taschereau".

1987 Highlights

A new rights management regime came into effect in February with the enactment of the Canada Petroleum Resources Act. This new legislation repeals and replaces the 1982 Canada Oil and Gas Act and brings into law the government's frontier energy policy announced in 1985. The legislation provides for three new licences (for exploration, significant discovery and production) and modifies the structure of the Environmental Studies Research Funds.

In 1987 COGLA, in concert with other interested federal departments, began the review of the Oil and Gas Production and Conservation Act in light of the recommendations of the Hickman Royal Commission on the *Ocean Ranger*. Proposed amendments to the act will be discussed with the accord provinces and industry prior to consideration by Parliament.

In April, the governments of Newfoundland and Labrador and of Canada simultaneously proclaimed the Canada-Newfoundland Atlantic Accord Implementation Acts. The acts implement the 1985 Atlantic Accord, which provides for joint federal-provincial management and revenue sharing with respect to exploration and development of petroleum resources off Newfoundland and Labrador.

The Nova Scotia legislature passed the Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation Act in May. The federal implementing legislation was tabled in Parliament in June and was before legislative committee at year-end.

In June the Canadian and British Columbia governments released their joint response to the *West Coast Offshore Exploration Environmental Assessment Panel Report*, which opens the door to renewed exploration for oil and gas off the coast of British Columbia. The two governments accepted the intent of most of the panel's 92 recommendations and announced that the federal and provincial moratoriums that have barred exploration in northern waters off the west coast since the early 1970s would be lifted.

Negotiations began between Canada and British Columbia during 1987 toward developing a Canada - British Columbia accord that would establish a joint resource management and revenue-sharing regime for offshore petroleum resources. A northern accord was also being considered to significantly increase the responsibilities of the territorial governments for the management of petroleum resources in the North.

Exploration rights were issued under the old Canada Oil and Gas Act in the Fort Good Hope area. The Minister of Indian Affairs and Northern Development and representatives of Chevron Canada signed the Exploration Agreement, the last to be issued under the previous legislative regime, in Fort Good Hope on November 2. Chevron and the community entered into a joint venture agreement that provides for local participation in the management of exploration activities.

During the year ten exploratory and four delineation wells were drilled on frontier lands, 42 fewer than in 1986. There was one significant gas discovery, the Liard F-25A gas discovery on the mainland of the southern Northwest Territories. Each of the three tested delineation wells was successful, confirming the presence of oil and gas reserves in existing significant discoveries.

Petro-Canada conducted an extended flow test of Panuke F-99, the first delineation well on Shell's 1986 Panuke oil discovery on the Scotian Shelf. The test lasted six days, producing 3700 m³ of oil, which was shipped by tanker to a refinery in Montreal. This operation marks the first oil shipment from the east coast offshore.

Panarctic continued seasonal production and transport of oil from its Bent Horn development project; there were two oil shipments in August and September. The company sold part of the production to northern markets as a replacement for costly southern diesel oil.

Federal-Provincial-Territorial Management of the Frontier Lands



The COGLA-Inuvialuit Environmental Impact Screening Committee meeting in Inuvik, October 1987. Courtesy W. Greenall.

Joint Management

The federal government manages oil and gas activity on frontier lands jointly with provincial governments in those offshore areas covered by accords, currently the Newfoundland and Labrador and Nova Scotia offshore areas. The provinces have an equal say in the legislation and policies regulating oil and gas activities in their respective offshore areas. The provinces also receive oil and gas revenues from the offshore as if the resources were on land.

The accords with Newfoundland and Nova Scotia each establish an independent offshore board to manage and administer petroleum operations in the offshore area. These boards comprise an independent chairperson and an equal number of federal and provincial appointees. The boards make all decisions on offshore operations. Fundamental decisions, however, are subject to ministerial review.

The implementing legislation for the accords incorporates the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act. The regulations promulgated under the implementing legislation correspond to those that apply throughout the balance of Canada's frontier lands. These provisions of the joint management regime ensure consistent regulation of Canada's frontier lands.

Shared management, based on the principle of equality of governments, is a reality in Newfoundland and Nova Scotia. The Government of Canada has a clear commitment to shared management in other frontier areas. A northern accord, which was being considered in 1987, would significantly increase the responsibilities of the governments of the Yukon and the Northwest Territories for the management of petroleum resources. The structure and scope of shared

management arrangements are matters for bilateral discussion with the provinces and the territorial governments.

Newfoundland and Labrador

Implementation of the Atlantic Accord

The governments of Newfoundland and Labrador and of Canada simultaneously proclaimed the Canada-Newfoundland Atlantic Accord Implementation Acts on April 4. The acts implement the 1985 Atlantic Accord, which provides for joint management of petroleum exploration and development activities off Newfoundland and Labrador.

Canada-Newfoundland Offshore Petroleum Board

In its first complete fiscal year of operations ending March 31, the board held 11 meetings dealing with land management, geophysical exploration and drilling results in the offshore. At the end of 1987, operators held rights over approximately 2 million hectares under 21 exploration licences. Seventeen significant discovery area declarations had been made. Exploration operations in seven active wells brought more than \$382 million in expenditures to the Newfoundland offshore.

The board is developing memorandums of understanding with federal and provincial departments to ensure coordination in the areas of environment, fisheries, benefits and marine safety.

Nova Scotia

The Nova Scotia Accord

The Nova Scotia legislature passed the Canada - Nova Scotia Offshore Petroleum Resources Accord Implementation Act in May. The federal implementing legislation was tabled in Parliament in June, and was under review by legislative committee at the end of 1987. Together, the federal and provincial acts will establish joint management and revenue sharing in petroleum resources off Nova Scotia. The acts will also create a new independent board, the Canada - Nova Scotia Offshore Petroleum Board, to manage offshore petroleum resources for both governments.

Canada - Nova Scotia Offshore Oil and Gas Board

The Canada - Nova Scotia Offshore Oil and Gas Board, established by the 1982 Canada - Nova Scotia Agreement, met six times in 1987.

The recovery of world oil prices from their mid-1986 slump sustained operators' interest in the Nova Scotia offshore. Husky/Bow Valley, Mobil and Shell Canada presented their assessments of the Scotian Shelf to the board.

Texaco Canada kept the board informed of its biophysical and geophysical studies on the Georges Bank and its ongoing consultations with local communities and fishing groups.

The board implemented the federal and provincial governments' benefits policies for petroleum activity and determined how companies should report on the benefits they provide. A set of guidelines for the approval and the reporting of benefits was distributed to companies operating off Nova Scotia.

At the end of 1987, the board reported that operators held rights over approximately 655 331 million hectares under 17 exploration agreements. Twenty significant discovery area declarations had been made.

Yukon Territory and Northwest Territories

COGLA continued to cooperate closely with the Government of the Northwest Territories and the Government of the Yukon Territory in keeping with the spirit of the frontier energy policy of 1985. COGLA also consulted special interest groups on northern oil and gas regulatory issues.

Most of the existing exploration rights in the North matured in 1987, and 38 exploration licences, mostly in the Mackenzie Valley, were renewed for three-year onshore and four-year offshore terms.

Exploration rights were issued in a unique way in the Fort Good Hope area. The exploration agreement was concluded under the old Canada Oil and Gas Act (COGA), which has since been replaced by the Canada Petroleum Resources Act (CPRA). The Minister of Indian Affairs and Northern Development and representatives of Chevron Canada signed the exploration agreement in Fort Good Hope on November 2. Chevron and the community have entered into a joint venture that provides for participation in exploration activities and local benefit opportunities.

COGLA worked closely with the Government of the Northwest Territories in responding to requests from communities for information on frontier energy policy and rights issuance under CPRA. Consultations on new rights issuance with Fort Norman and Arctic Red River continued. Information meetings were also held with the Deh Cho Regional Council.

In the Yukon Territory, COGLA consulted parties interested in a rights issuance in the Whitehorse Basin area. The City of Whitehorse, the Kwanlin Dün Band and two companies remain interested in oil and gas exploration activity. However, the land selection process to settle comprehensive land claims must be completed before exploration rights can be issued in the Whitehorse Basin.

Implementation of the Inuvialuit Final Agreement

In the western Arctic, COGLA met with the Environmental Impact Screening Committee, an Inuvialuit-government advisory body established by the 1984 Inuvialuit Final Agreement. COGLA provided the committee with a summary of the approvals and authorizations issued under the Oil and Gas Production and Conservation Act and CPRA. COGLA undertook to remind operators of the screening provisions of the Inuvialuit Final Agreement.

British Columbia

The Canada - British Columbia Agreement

After the joint federal-provincial response to the *West Coast Offshore Exploration Environmental Assessment Panel Report*, both governments announced that offshore activity could be allowed to proceed provided certain conditions were being met. The federal and provincial moratoriums on exploration in the northern waters off the west coast, which have been imposed since the early 1970s, will be lifted, opening the door to renewed oil and gas exploration off the coast of British Columbia. Discussions of a possible Pacific accord between Canada and the province were under way at year's end.

Rights Management

COGLA issues and manages oil and gas exploration and production rights in Canada's North and certain offshore frontier areas under the authority of the ministers of Indian Affairs and Northern Development, and Energy, Mines and Resources. It also administers federal mineral rights within the provinces on behalf of the Minister of Energy, Mines and Resources.

A new rights management regime came into effect on February 15 with the proclamation of the Canada Petroleum Resources Act (CPRA). The legislation provides for three new forms of licences: exploration, significant discovery and production. Regulations in respect of registration of oil and gas rights, updating the survey system on frontier lands and the imposition and collection of royalties are being developed under CPRA.

During 1987, most of the exploration licences in the North matured and either reverted to Crown reserve or were renewed for three-year terms onshore or four-year terms offshore. An exploration agreement was issued under the Canada Oil and Gas Act (COGA) in the Fort Good Hope area. No new rights were issued under CPRA, which has replaced COGA.

COGLA discussed the development of new forms of licences and cooperated in drafting regulations, policies and guidelines with the Canada-Newfoundland Offshore Petroleum Board, the Newfoundland-Labrador Department of Energy, the Canada - Nova Scotia Offshore Oil and Gas Board and the Nova Scotia Department of Energy. At year-end, COGLA was discussing these issues with industry.

FRONTIER LAND HOLDINGS (at Year-End)	1983	1984	1985	1986	1987
Number of Exploration Licences/Agreements Active*	120	153	150	118	112
Lands Negotiated into Exploration Licences/Agreements (millions of ha)	25.0	21.2	24.9	4.1	7.3
Lands Relinquished or Surrendered (millions of ha)	1.6	24.7	20.0	39.2	15.1
Lands Active* (millions of ha)	115.4	89.5	70.8	33.5	20.6

* Includes declared significant discovery areas.

LAND STATUS AT YEAR-END, 1987

	Active Exploration Licences/ Agreements*	Lands Relinquished or Surrendered	Lands Negotiated into Exploration Licences/ Agreements	Lands Active	Pending Lands**
(millions of ha)					
Mainland Territories	29	4.7	4.5	2.3	1.1
Mackenzie Delta and Beaufort Sea	28	1.4	2.1	2.9	0
Arctic Islands and Eastern Arctic Offshore	16	5.9	0.3	1.6	2.4
Hudson Bay	1	0.2	0	11.4	1.4
Grand Banks and Labrador Sea	21	1.8	0.1	1.7	1.5
Nova Scotia Offshore (includes Gulf of St. Lawrence)	17	1.1	0.3	0.7	3.4
West Coast	0	0	0	0	8.7
Total	112	15.1	7.3	20.6	18.5

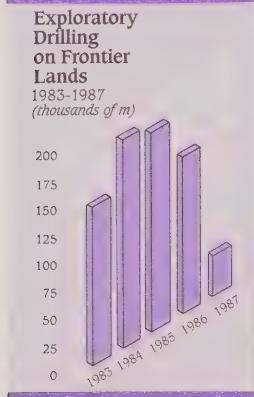
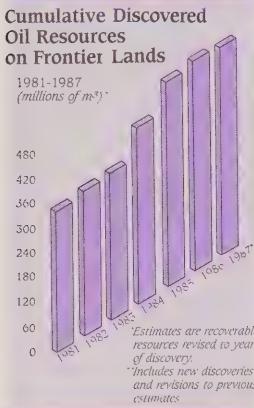
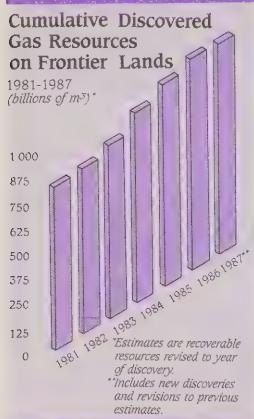
* Includes declared significant discovery areas.

** Includes areas where exploration activity has been suspended: west coast, Baffin Bay, Georges Bank, St-Pierre et Miquelon, etc.

EXPLORATION LICENCES/AGREEMENTS NEGOTIATED IN 1987

Operating Company	Exploration Licence/ Agreement Number	Number of Licences/ Agreements	Area (thousands of ha)	Location	Term (years)
Shell	298, 299	2	202	Scotian Shelf	3
PCI	300	1	9	Scotian Shelf	6
Mobil	301	1	56	Grand Banks	4
PCI	302	1	442	Tweed Lake	3
PCI	303	1	366	Mackenzie Plains	3
Dome	304	1	333	Colville Hills	3
Amoco	305-307	3	278	Southern Territories	3
PCI	308	1	64	Cameron Hills	3
Esso	309	1	318	Lac des Bois	3
Coho	310	1	40	W. Cameron Hills	3
Texaco	311	1	51	Arrowhead	3
Paramount	312	1	32	Cameron Hills	3
Dome	313	1	231	Rond Lake	3
Sulpetro	314	1	95	Trout Lake	3
Wes Dec.	315, 316	2	476	Mackenzie Valley	3
Placid	317	1	175	Beaufort Sea	4
Texaco	318	1	48	Norman Wells	3
Amerada	319	1	104	Fort Norman	3
Chevron	320	1	25	Liard	3
Westmin	321	1	129	Eagle Plain	3
Chevron	322	1	426	Fort Good Hope	8
Panarctic	323-325	3	281	Arctic Islands	4
PCI	326-328	3	960	Southern Territories	3
Dome	329-332	4	1280	Beaufort Sea	4
Amoco	333	1	152	Liard	3
Placid	334	1	326	Beaufort Sea	4
Shell	335	1	156	Mackenzie Delta	3
Gulf	336	1	173	Mackenzie Delta	3
Chevron	337-339	3	69	Mackenzie Delta	3

Exploration Activity



A total of 17 wells were active on frontier lands during the year. Although this number is far below figures for the preceding three years — when there was unusually high activity — it is comparable to levels of activity between previous peaks in the exploration cycle. Fourteen wells were terminated in 1987, six in the North and eight on the east coast offshore. At year-end, one well had been suspended and drilling was under way at two other locations. The proportion of delineation drilling to exploratory drilling increased, indicating industry interest in confirming reserves in known discoveries to prepare for eventual production. All three tested delineation wells were successful. One of the 10 terminated exploration wells, Northcor et al. Liard F-25A in the southern Northwest Territories, was reported to be a significant gas discovery.

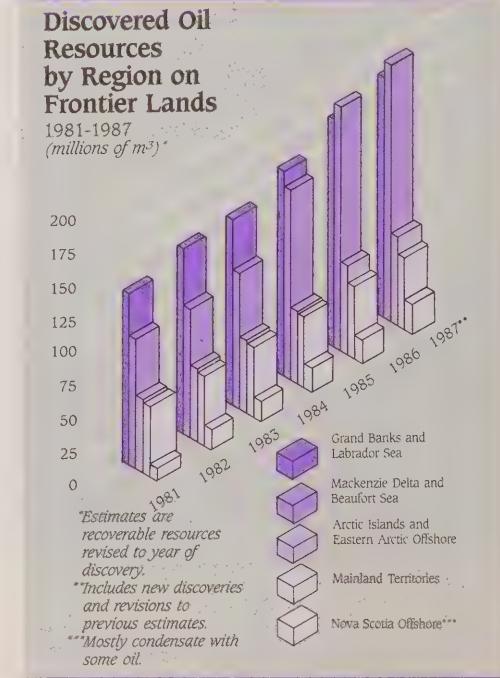
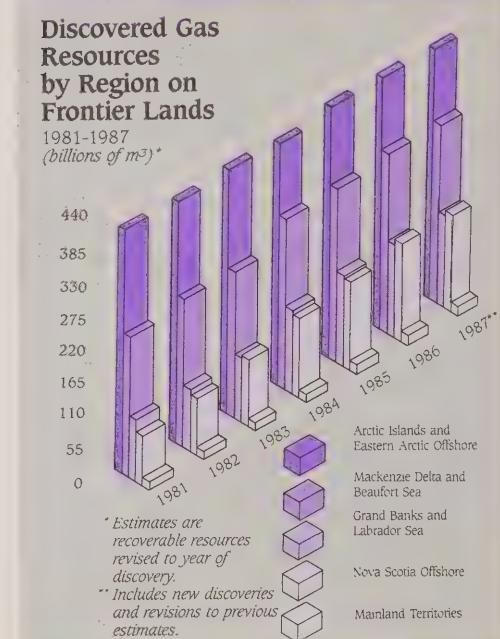
The North

The successful evaluation of the Amauligak oil field, the new significant gas discovery in the southern Northwest Territories, and further evaluation of the Bent Horn oil field highlight northern exploration.

Beaufort Sea

The Beaufort Sea continues to be the most important area for exploration and development in the North. Two delineation and two exploratory offshore wells were active in 1987. Early in the year, Gulf Canada announced its plan to resume delineation drilling on the 1984 Amauligak oil and gas discovery. The drilling of two or possibly three delineation wells is planned for 1987-88 using the *Molikpaaq*, a mobile arctic caisson, from a berm on the eastern part of the pool. The first of these, Gulf et al. Amauligak F-24, is the third delineation well within the field. Amauligak F-24 reached total depth and will be tested in the summer of 1988. The second delineation well for 1987-88, Amauligak 2F-24, was spudded in December.

The two exploratory wells yielded disappointing results; both were dry and abandoned. Esso Canada drilled Esso et al. Kauvik I-43 from an artificial island in the central Beaufort. Trillium et al. Angasak L-03 was drilled from an artificially thickened ice platform off the northern tip of the Tuk Peninsula, marking the first use of this drilling platform in the Beaufort Sea.



Mainland Territories

Two exploratory wells were terminated, both in the southern Northwest Territories. Northcor et al. Liard F-25A, 10 km northeast of the Pointed Mountain gas field, was tested early in 1987. The well, a follow-up to the Liard F-25 dry hole, had been drilled to total depth in late 1986. Drillstem tests of Liard F-25A flowed gas to the surface at a stabilized rate of 249 000 m³ per day, establishing a significant gas discovery. Northcor's press release indicated that the company was examining the feasibility of linking the well to the Pointed Mountain gas plant. The second exploratory well, PCI et al. North Cameron C-24, was drilled in the Cameron Hills area in the summer and abandoned without testing.

Arctic Islands

Late in the year, Panarctic drilled an exploratory well, Bent Horn F-72B, to a deeper reservoir section underlying the known Bent Horn oil field. Panarctic was hoping to increase the reserves available for production under the known field and establish a back-up to the current production well, Bent Horn A-02. Bent Horn F-72B was drilled from the well bore of the 1975 Bent Horn F-72A, and reached a total depth of 3278 m. Panarctic abandoned the well without testing.

East Coast Offshore

Drilling activity in the east coast offshore was concentrated in the traditionally active areas, near Sable Island off Nova Scotia and near Hibernia off Newfoundland. Three successful delineation wells, one off Nova Scotia and two off Newfoundland, highlight 1987 activity.

Nova Scotia Offshore

Three wells were terminated off Nova Scotia, one delineation and two exploratory. Petro-Canada drilled a successful delineation well, PCI et al. Panuke F-99, on Shell's 1986 Panuke oil discovery. Oil flowed on drillstem tests at rates up to 918 m³ per day. To evaluate reservoir quality and production capability, an extended flow test was conducted over a six-day period. The test produced about 3700 m³ of oil into a tanker. The oil was transported to a refinery in Montreal, the first time that oil has been shipped from the east coast offshore.

Both exploratory wells were dry and abandoned. Petro-Canada drilled PCI et al. Como P-21, 17 km west of the Cohasset oil discovery, hoping for another oil discovery in the Cohasset-Panuke oil field. Canterra et al. Whycocomagh N-90, drilled to 3536 m at a location between earlier significant gas discoveries at Glenelg and Alma, was abandoned without testing.

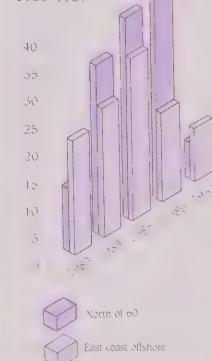
Newfoundland Offshore

The Newfoundland offshore was the most active area on the frontier lands, with four delineation wells and three exploratory wells. Two operators reported successful delineation drilling. In late 1987, Petro-Canada began a delineation drilling program at Terra Nova to further evaluate the extent of the oil pool. Petro-Canada et al. Terra Nova H-99, the fifth delineation well at Terra Nova, was tested. It flowed oil at 1192 m³ per day, confirming the existence of a good-quality, productive reservoir section in the northeastern quadrant of the structure. The sixth delineation well, Terra Nova C-09, was spudded in early December immediately north of the Terra Nova discovery well.

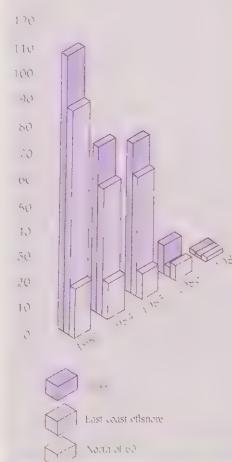
Husky/Bow Valley reentered HBV et al. North Ben Nevis P-93, the first delineation well on their 1986 discovery of gas and oil. Two drillstem tests conducted over separate intervals flowed oil at 864 m³ per day and gas at 110 000 m³ per day. Husky/Bow Valley later continued delineation drilling at the Whiterose gas and oil discovery. The fourth delineation well, HBV et al. Whiterose E-09, was drilled to 3811 m before it was temporarily suspended late in the year for repairs and certification surveys on the *Bow Drill 3* drilling unit.

Exploration drilling included three unsuccessful exploratory wells. Husky/Bow Valley drilled two exploratory wells, HBV et al. Golconda C-64 and HBV et al. Bonne Bay C-73, and abandoned both without testing. Northcor and partners undertook the only drilling outside the Hibernia area at Northcor et al. Narwhal F-99 on the continental slope. Narwhal F-99 was drilled in 1574 m of water, the deepest water for any offshore Newfoundland well to date. After it was drilled to 4575 m, the well was abandoned without testing.

Number of Wells Terminated
1985 1987

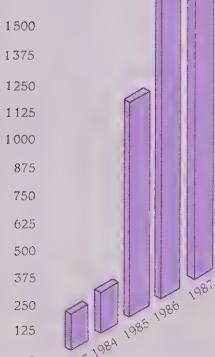


Reflection Seismic Shot on Frontier Lands
1985-1987 (thousands /km²)



Conservation and Development

Oil Production on Frontier Lands 1983-1987 (thousands of m³)



Gas Production on Frontier Lands 1983-1987 (millions of m³)



COGLA is responsible for regulating the development and production of oil and gas on frontier lands, while ensuring effective conservation of these valuable, nonrenewable resources.

Norman Wells, Mainland Territories

COGLA analyzed the production data and performance of the Norman Wells field to ensure that Esso had met the terms and conditions established in 1980 when the site's waterflood expansion program was approved. The analysis confirmed that the program had succeeded: oil production flow rates had stabilized, the gas-oil ratio had decreased and the reservoir pressure had increased.

Production from the Norman Wells field in 1987 totaled 1 531 000 m³ of oil, an increase from 1 411 000 m³ in 1986. The daily average oil rate of 4165 m³ per day peaked in December at 4860 m³ per day. Consequently, gas production in 1987 decreased to 163 000 000 m³. The average gas-oil ratio continued a downward trend and decreased to 100, compared with 133 in 1986.

Additional drilling increased the active well count to 168 producers and 146 injectors. Additional wells not only increased the recoverable reserves, but also improved waterflood efficiency by improving the producer-injector ratio. Esso upgraded existing processing facilities to ease the handling of larger volumes of produced water and the processing of gas.

Pointed Mountain, Mainland Territories

Gas production from the Pointed Mountain gas field continued to decline in 1987. The field produced 156 000 000 m³ compared with 205 000 000 m³ in 1986. Cumulative gas production to year-end totaled 7 831 000 000 m³.

Amauligak, Beaufort Sea

COGLA finished examining the data from the 1986 extended flow test on the Amauligak I-65B well. Based on these analyses, guidelines were developed for the running of future extended flow tests.

A delineation program at the Amauligak F-24 site, on the east side of the Amauligak structure, was approved. Data gathered from this drilling and testing program will be incorporated into a reservoir description for a reservoir simulation study, which will help evaluate production alternatives for the field.

Bent Horn, Arctic Islands

The Bent Horn storage facilities were expanded in 1987 by about half, from 17 161 m³ to 25 551 m³. For the third consecutive year, Panarctic shipped oil to southern markets — two tanker loads. The first shipment began loading August 26 and 23 930 m³ of oil was transferred to the MV *Arctic*. En route to Montreal, the vessel transferred 1930 m³ at Resolute for the Northern Canada Power Commission. The MV *Arctic* returned to the Bent Horn site on September 15 and a second shipment, 18 689 m³ of oil, was transferred to the vessel. The ship proceeded to Little Cornwallis Island and delivered 5403 m³ of oil at the Polaris mine. The rest of the oil was transferred near Devon Island to the *Irving Nordic*, for delivery to the Petro-Canada refinery in Montreal.

Bent Horn more than doubled its 1986 production. The well produced 34 523 m³ of oil in 1987, compared with 17 522 m³ in 1986. Cumulative oil production to year-end was 81 539 m³.

Hibernia, Newfoundland Offshore

To address conservation issues raised in Mobil's Hibernia Development Plan Application (HDPA), COGLA conducted a detailed geological and engineering study of the Avalon and Hibernia sandstone reservoirs. A computerized reservoir description system generated net pay, porosity and permeability data for both reservoirs. Several two-dimensional, multi-layered, cross-sectional models were used to produce the data needed to create the three-dimensional models.

For the Avalon sandstone, COGLA conducted waterflooding studies for the HDPA and surrounding areas. Testing at the Hibernia B-08 well suggested a naturally occurring miscible bank in the Hibernia sandstone. This prompted evaluation of both waterflood and miscible flood three-dimensional models for the Hibernia sandstone. The gas flood model achieved miscibility, and preliminary results from the calculations were encouraging. The study developed oil rate predictions and estimates of oil recovery for both the Avalon and Hibernia reservoirs.

Terra Nova Oil Field, Newfoundland Offshore

Petro-Canada initiated a delineation drilling program to confirm the presence of additional oil reserves in the Terra Nova structure. The PCI et al. Terra Nova H-99 well, the fifth delineation well for the structure, flowed oil and confirmed the existence of a good-quality production reservoir section in the structure. The sixth delineation well was being drilled at year-end. When the delineation program is completed, Petro-Canada is expected to file a development plan application, using a floating production system, with the Canada-Newfoundland Offshore Petroleum Board. COGLA is currently reviewing the oil reserve estimate for Terra Nova.

Venture, Nova Scotia Offshore

COGLA completed a study to develop an optimal depletion strategy for a high-pressure, multi-sand reservoir, such as that found in the Venture field. This study evaluated the complications associated with balancing the tasks of maximizing the gas flow rate, obtaining reservoir engineering data and maximizing resource conservation. The results were published in the Venture Gas Field Depletion Study.

Cohasset Oil Field, Nova Scotia Offshore

Based on the results of PCI et al. Cohasset A-52, the second delineation well on the Cohasset structure, additional reservoir engineering evaluations were conducted to determine reserve estimates. In anticipation of future development, Petro-Canada began looking at production alternatives and facilities design for the field.

Panuke Oil Field, Nova Scotia Offshore

A delineation well, PCI et al. Panuke F-99, confirmed the oil zone found in the discovery well Panuke B-90. Petro-Canada tested the Panuke F-99 well for six days and produced about 3700 m³ of oil at rates up to 918 m³ per day. The company is conducting conceptual studies on production alternatives.



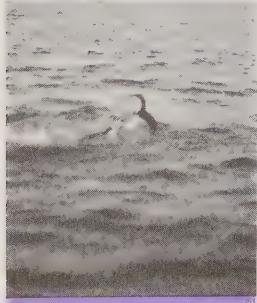
Panarctic's Bent Horn facility on Cameron Island in the High Arctic. Courtesy K. Singh.



The MV Arctic loading crude oil at the Bent Horn production site. Courtesy F.R. Engelhardt.

Protection of the Worker

Regulations and Guidelines



Since its inception in 1981, COGLA has been responsible for ensuring, through the Oil and Gas Production and Conservation Act, the health and safety of petroleum workers on frontier lands. COGLA has been consulting with the Newfoundland and Nova Scotia governments and with the Canada-Newfoundland Offshore Petroleum Board on all regulatory initiatives concerned with health and safety of petroleum workers.

To enhance the safety of every work site, COGLA collaborated with Labour Canada to develop the Canada Oil and Gas Occupational Safety and Health Regulations, promulgated at the end of October under Part IV of the Canada Labour Code. Under a memorandum of understanding with Labour Canada, COGLA is responsible for applying Part IV of the code to personnel employed in the exploration, production, processing, conservation or transportation of oil and gas on frontier lands. The new regulations set out specific minimum standards for the work site including lighting, noise levels, material-handling equipment, sanitation and drinking water quality.

COGLA, in cooperation with the provinces of Nova Scotia and Newfoundland, is continuing its revision of the technical aspects of the Canada Oil and Gas Drilling Regulations. The revisions will take into account advances in drilling technology and procedures, as well as the necessary amendments to conform with Part IV of the Labour Code. COGLA will be consulting with the industry once the amended regulations are drafted.

COGLA continued drafting the Canada Oil and Gas Production Installations Regulations. As part of developing appropriate and effective standards for these regulations, COGLA reviewed present practices in selected areas of production. The results formed the basis of five reference manuals for providing safe working practices at production sites. The latest draft of the regulations have been sent to industry for review and comment.

During the past year COGLA introduced a scheme for a certificate of fitness for production structures. Guidelines for qualifying an organization as a certifying authority were compiled. Other guidelines describing the duties of a certifying authority when assessing production installations were also formulated.

Safety drill: man overboard wearing a survival suit.

Standards for Survival Suit Systems

By regulation, helicopter crew members and passengers must wear immersion suits when a helicopter supporting a drilling unit offshore is traveling over water. In December 1986, the Canadian General Standards Board published the Helicopter Passenger Transportation Suit Systems standard. COGLA chaired the committee involved in the drafting of this standard. The standard describes the detailed design and performance requirements for immersion suits to be used in Canada's frontier areas. All operators must comply with this standard by July 1988.

COGLA is also significantly involved in developing standards for marine abandonment and working suits. These standards are almost complete and suits meeting the standards will likely be on the market before the end of 1988.

Canadian Standards Association Offshore Code

COGLA serves on the Canadian Standards Association (CSA) steering and technical committees that are developing a code for the design, construction and installation of fixed offshore production structures. Preliminary standards for design criteria and loads, foundations, steel structures, concrete structures and sea operations will be published in 1988. COGLA and CSA have also begun reviewing and verifying the code's technical and practical aspects.

Geopressure Drilling Task Force

The Geopressure Drilling Task Force (GDTF) reported on its major areas of investigation, including pressure prediction, pressure detection, tubular design, and well-control equipment and procedures. The report recommended practices to promote safety among operators drilling in geopressed formations. The task force, a joint COGLA-industry effort, was formed in 1986 to respond to the concerns in the COGLA-commissioned report, *An Examination of Safety Procedures and Practices Used in Exploratory Drilling Operations Conducted in Abnormally Pressured Formations in the Scotian Shelf Area*. The GDTF report will be recommended to all operators drilling in geopressed areas.

Safety Training

COGLA serves on a technical committee that is developing a training program to protect petroleum workers from hydrogen sulphide gas. The committee includes provincial governments, the Petroleum Industry Training Service, the Canadian Association of Oilwell Drilling Contractors and other industry associations. Training will be mandatory for oil field workers who may encounter this extremely toxic gas during their duties.

This year COGLA developed survival training guidelines for the east coast and the North. On the east coast, these guidelines were aimed primarily at workers who have been temporarily absent from the offshore and need retraining. In the North, similar guidelines are mainly for workers who need basic marine safety training.

Inspections

COGLA carries out on-site inspections during the course of a drilling or production program to assess the safety and effectiveness of the operation and to ensure compliance with regulations and guidelines. In 1987, COGLA conducted 50 inspections.

In 1987, under a Memorandum of Understanding between COGLA and Labour Canada, COGLA inspectors were appointed safety officers. As a result, they are responsible for the monitoring of safety and health in the work place and the enforcement of Part IV of the Canada Labour Code where frontier oil and gas activities are carried out.

Lost-Time Accidents

The accident rate for drilling operations, calculated as the number of lost-time accidents (LTAs) per million person-hours worked, decreased significantly in 1987 to 9.7 (compared with 22.4 in 1986). In addition to the LTAs listed in the accompanying table, six others were reported on the frontier lands in production-related activities. There were no fatalities associated with oil and gas exploration or production in 1987.

Sea Ice and Icebergs

Only one drilling rig operated on the Grand Banks during the 1986-87 ice season. Husky/Bow Valley's *Bow Drill 3* was drilling at Bonne Bay C-73 on February 25 when pack ice encroached. Once it became apparent that the ice was going to stay, the drilling unit left for Mortier Bay for annual inspection and repairs. Later in the season, several icebergs moved southward over the Grand Banks; few approached the drilling site, however, and only one had to be towed.

For the second consecutive year, ice conditions in the Beaufort Sea were favorable. There was more open water than usual and the open-water season lasted longer. During the year there were fewer than normal concentrations of multiyear ice, which frequently impedes drilling operations.

Gulf took advantage of the longer than usual open-water season that existed after mid-July to complete berm construction and set down the *Molikpaq* at the Amauligak F-24 site in September.



Husky/Bow Valley's Bow Drill 3 showing the Preferred Orientation and Displacement (PROD) device (boom at left). Courtesy Canada-Newfoundland Offshore Petroleum Board.

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1987

	Person-Hours at Work Site		Lost-Time Accidents		Accident Rate	
	Drilling Unit	Standby/Supply Vessel	Drilling Unit	Standby/Supply Vessel	Drilling Unit	Standby/Supply Vessel
Mainland Territories	228 720	N/A	0	N/A	0	N/A
Mackenzie Delta and Beaufort Sea	605 139	245 028	6	6	9.9	24.5
Arctic Islands and Eastern Arctic Offshore	42 000*	N/A	1	N/A	23.8	N/A
Grand Banks and Labrador Sea	533 560	205 155	8	19	15.0	92.6
Nova Scotia Offshore	133 450	41 754	0	0	0	0
Total	1 542 869	491 937	15	25		

*Estimated.
N/A - Not applicable.

Protection of the Worker



COGLA personnel traveling offshore wearing approved survival suits. Courtesy M. Thomas.

Research and Development

Canadian environmental conditions often demand that new technologies be developed, assessed and implemented or that established technologies be adapted to unique circumstances. Research and development (R&D) is an integral component of COGLA's activities.

The Program for Energy Research and Development (PERD) of the Department of Energy, Mines and Resources helps to ensure that the federal government has the technical knowledge to fulfil its regulatory responsibilities for the production of crude oil, natural gas and electricity efficiently and safely.

COGLA administered several major R&D projects under PERD in 1987, chaired the Marine Engineering Committee, and served on the geoscientific, offshore geotechnics, materials, transportation and environment committees. Research studies and projects were initiated in rig evacuation, improved emergency equipment and sea rescue techniques, standards for the design, construction and installation of offshore structures, protection of pipelines, and ice-structure interaction. Some of these important studies are described below.

Preferred Orientation and Displacement Lifeboat Launching System

The Preferred Orientation and Displacement (PROD) system is designed to direct a lifeboat safely away from a drilling unit as the craft is being launched. Following successful testing, the system was approved in 1987 as supplementary lifesaving equipment on semisubmersible mobile offshore drilling units. Two PROD units were installed on the *Bow Drill 3* operating off Canada's east coast. Watercraft International, the company that developed the PROD system, has since carried out further trials to adapt the system to fixed production platforms in the North Sea.

Lifeboat Occupant Recovery System

The Lifeboat Occupant Recovery System (LORS), conceived by Husky/Bow Valley, was under development in 1987. It evolved from the PROD system evaluation, which recognized that an evacuation is not complete until survivors are safely removed from the lifeboat. LORS is designed to ensure safe transfer of lifeboat occupants to a recovery vessel.

A hinged and floating boom installed on the recovery vessel is arranged to allow the recovery of the lifeboat. Once the lifeboat is secured to the boom, the lifeboat occupants can be transferred to the vessel by such methods as inflatable ramps, rescue baskets or individual rescue harnesses.

The project was financially and technically supported by COGLA through PERD, and by the Newfoundland and Nova Scotia governments. The U.K. Department of Energy also financed parts of the program.

Personnel Transfer Basket

This joint government-industry project developed a safer method for transferring people from a drilling unit to a recovery vessel. In severe weather, transferring workers by crane-basket can be hazardous and time-consuming. The improved Personnel Transfer Basket (PTB) prototype reduces evacuation time and offers more protection to passengers with its improved shock-absorbing features. Industry will continue to develop and market the PTB.

Seismic Hazard Maps for Canada's Frontier Regions

The safe design and operation of offshore structures must consider the risk of seismic activity. COGLA, under funding from PERD, oversaw the production of a series of seismic hazard maps for eastern Canadian offshore regions and the initiation of work on maps for the Beaufort Sea and Arctic regions. When complete, the maps will become part of the database that will be used to develop new Canadian standards for the design, construction and installation of fixed offshore structures.

Design of Arctic Offshore Installations and Pipelines

COGLA has been playing a leading role in the development of analytical methods for the design of arctic installations such as caisson-type structures, artificial islands and arctic offshore pipelines. In 1987 COGLA cochaired an international workshop on geotechnical modeling. The results of this workshop have been instrumental in directing further research in North America.

COGLA initiated a research program that will bring together geotechnical and coastal engineering in the analysis of wave-seabed interaction. The goal is to improve physical and numerical modeling techniques for a better understanding of hydraulic erosion and settlement problems around shallow water gravity structures.

COGLA is the major partner in a joint industry project initiated this year to look at local ice loads and ice-structure interaction at the Amauligak F-24 site. COGLA also engaged a consortium of companies to look at the criteria for protecting arctic offshore pipelines from ice scour.

Environmental Design Criteria

A government-industry working group is preparing an extensive climatology of east coast waves. The project team includes representatives from the Atmospheric Environment Service (AES), and the federal departments of National Defence, Fisheries and Oceans, and Transport, as well as COGLA and Mobil. The program will provide operational experience using wave models, a seven-year archive of wave data, and a detailed record of the 50 most extreme storms on the Grand Banks and the Scotian Shelf.



With the resumption of activity at Amauligak, the need for information about Beaufort Sea winds, waves and currents became critical. A government program of the Marine Environmental Data Service and the Institute of Ocean Sciences (both of Fisheries and Oceans), the Canadian Climate Centre (part of AES) and COGLA is establishing a storm climatology for the southern Beaufort Sea that will be useful for current and future developments in the area. This climatology will contain information on the winds, waves, and surface and bottom currents for the 20 largest storms since 1977. It will be complete in 1989.

On-site inspection of Panarctic's Bent Horn well site facilities, the northernmost producing well in Canada. Courtesy D. Dempster.

Protection of the Environment



The scallop: a key species on Georges Bank. Courtesy Department of Fisheries and Oceans.

Lobster (*Homarus americanus*) on the east coast. Courtesy Department of Fisheries and Oceans.



On the East Coast

Georges Bank

COGLA continued updating and assessing environmental information on Texaco's proposal to start exploration on Georges Bank, including the screening statement prepared in 1986 by the Canada - Nova Scotia Offshore Oil and Gas Board. Texaco has launched several environmental studies related to its proposed drilling program. These include laboratory toxicity and tainting studies, surveys for scallops and lobsters in the area around the proposed drill sites, and modeling studies to predict the off-site movement of operations-related fluids. Texaco intends to include this material in its public information and consultation program.

Texaco visited the fishing communities of southwest Nova Scotia to explain its exploration proposal. This consultation effort, begun in 1986, involved the establishment of information centres in three Nova Scotia communities (Yarmouth, Barrington Passage and Lunenburg), a series of meetings with municipal councils throughout the province, and many small, informal group discussions with fishermen and fish plant operators.

On the West Coast

Environmental Review

In June the federal and British Columbia governments released the joint government response to the *West Coast Offshore Exploration Environmental Assessment Panel Report*. COGLA played a major role in coordinating the federal response and preparing the document. The two governments accepted the intent of most of the panel's 92 recommendations, including the establishment of an environmental coordinating committee to provide expert advice on the possible environmental effects of proposed offshore exploration north of Vancouver Island. The committee will hold its first meeting in January to identify research needs.

In November, COGLA and the B.C. Ministry of Energy, Mines and Petroleum Resources participated in a consultation program in B.C. coastal communities and in the Queen Charlotte Islands. The program responded to the federal and provincial ministers' determination to work closely with B.C. residents to ensure that when the moratoriums are lifted, exploration will not disrupt the environment or the use of environmental resources.

In the North

Amauligak

Early in the year, Gulf indicated its intention to conduct delineation drilling and an extended production testing project at the Amauligak site. Gulf submitted a project description to the Environmental Impact Screening Committee, a joint government-Inuvialuit body created under the Inuvialuit Final Agreement. After completing its screening, the committee referred the proposed project to the Regional Environmental Review Committee (RERC) of Indian and Northern Affairs Canada. COGLA and RERC drafted guidelines for Gulf's preparation of a project plan for environmental protection and RERC recommended that the project proceed under certain conditions.

COGLA, RERC and Gulf developed a compensation program for the Inuvialuit covering potential wildlife harvest damages that might result from activities related to the Amauligak project.



Bent Horn

COGLA and other government agencies reviewed and approved Panarctic's plan to expand the capacity of the bermed oil storage area at the Bent Horn site. COGLA staff inspected the site to ensure that the company complied with its environmental protection plan. Staff also oversaw loading of the *MV Arctic* with this year's two oil shipments.

Consultations

Guidelines

COGLA, other government departments, the oil and gas boards, and industry continued preparing the offshore hydrocarbon drilling and production waste treatment guidelines pursuant to regulations.

Further consultations were held with the oil industry to develop guidelines for the environmental monitoring of oil spills. Guidelines dealing with well site surveys, meteorological, oceanographic and ice programs, contingency planning, the use of explosives and oil-based drilling muds continue to be evaluated and updated. Also, a newly formed government-industry task force began examining the environmental, engineering and regulatory problems associated with using diesel oil as a drilling fluid lubricant.

Memorandums of Understanding

In 1987 COGLA signed two memorandums of understanding to ensure the protection of the fisheries and the provision of environmental and ocean-related services in the Newfoundland offshore. The other signatories were: the Canada-Newfoundland Offshore Petroleum Board; the Newfoundland and Labrador Intergovernmental Affairs Secretariat and departments of Energy and Environment; and the federal departments of Environment and Fisheries and Oceans. These memorandums describe the guiding principles and consultative process to be followed.

Environmental Assessment

COGLA continued to be an active member of the Interdepartmental Committee on Environmental Assessment of the Federal Environmental Assessment Review Office. COGLA also served on several technical subcommittees evaluating environmental impact assessment methodologies, techniques, processes and procedures for activities on Canada's frontier lands.



Environmental Studies Research Funds

The Environmental Studies Research Funds (ESRF) support environmental and social research related to oil and gas exploration and development on frontier lands. The program, administered by COGLA, is funded through a levy on oil and gas companies holding interests on frontier lands.

The Canada Petroleum Resources Act (CPRA), proclaimed early in the year, modified the ESRF structure. The name of the program changed from Environmental Studies Revolving Funds to Environmental Studies Research Funds and a new management board replaced the original two advisory boards. ESRF regional regulations, which form the basis for levy calculations, were promulgated under CPRA.

No levies were collected in 1987 nor were any new studies initiated. A number of studies begun in previous years were completed and the results published and distributed through the ESRF technical report series. Almost one third of the more than 80 titles in the series were published in 1987. Some recently published reports include:

- *Local Business Adaptation to East Coast Offshore Energy Development.* This report presents guidelines to help local businesses deal more successfully with the oil industry. It is based on information obtained from the oil industry and local businesses experienced in obtaining and supplying goods and services for offshore oil and gas activities.

Field experiments to determine the behavior of oil in pack ice in the Cabot Strait, N.S. Courtesy S.L. Ross Environmental Research Ltd.

Protection of the Environment



Environmental conditions during experimental oil spill offshore Nova Scotia. Courtesy S.L. Ross Environmental Research Ltd.

- *Ice Scour Data Base for the Beaufort Sea.* This study provides designers of underwater facilities with a data base on more than 3500 ice scours in the Beaufort Sea. The data were obtained from industry and government records and each scour is described in a 27-column data base. This allows flexibility in data manipulation for deriving design criteria for safe installation of underwater petroleum facilities in the Beaufort Sea.
- *Monitoring the Long-Term Fate and Effects of Spilled Oil in an Arctic Marine Subtidal Environment.* This study, a follow-up to the 1981 Baffin Island Oil Spill experiment, examined the fate and biological effects of the spilled hydrocarbons four years later. The research showed that although hydrocarbon traces could still be found in the environment and some life forms had increased oil concentrations, few marine organisms had died and the underwater ecosystem had not changed significantly.
- *Field Research Spills to Investigate the Physical and Chemical Fate of Oil in Pack Ice.* Three small experimental oil spills were made in moderately and densely packed ice conditions off Cape Breton Island. The study found that these ice conditions effectively confine the oil and facilitate on-site burning. These observations will be useful in calibrating oil spill models and in planning more effective counter-measures.
- *The Use of Chemical Dispersants in Salt Marshes.* This study examined the effects of oil on typical tidal marsh vegetation and compared it with the combined effects of oil and a chemical dispersant used to counter oil spills. Findings revealed that the dispersant not only was ineffective in removing oil from vegetation, but also was more toxic to the plants than oil alone.

Northern Land Use Planning

In the Northwest Territories, COGLA participated in workshops held by the Lancaster Sound Regional Land Use Planning Commission in Resolute and Pond Inlet. A COGLA official chaired a working group on oil and gas that produced background material for the commission to help prepare a draft land use plan for the area. COGLA also offered suggestions to the commission following release of a discussion paper outlining proposals for a draft land use plan in October.

Employment and Industrial Benefits

Northern Developments

The most significant event in the Beaufort Sea during 1987 was Gulf's decision to return to Amauligak for further delineation drilling and testing. This gave a much needed boost to the local economy, which had been directly affected by the recent downturn in northern oil and gas activities. COGLA and the territorial government departments responsible for northern benefits met frequently with the operator to discuss the Canadian and northern benefits aspects of Gulf's extended formation testing program for Amauligak.

Farther north, Panarctic expanded its operations at Bent Horn, shipping two tanker loads of crude petroleum and drilling an exploratory well in the hope of increasing the project reserve base. The company negotiated the sale of part of its crude production as a replacement for costly southern diesel oil for use at Resolute by the Northern Canada Power Commission and at the Polaris mine by Cominco.

The new rights issuance to Chevron in the Mackenzie Valley resulted in a joint venture agreement between Chevron and the community of Fort Good Hope. This agreement should lead to increased employment opportunities for Fort Good Hope residents.

In the Mackenzie Valley, Esso continued its infill drilling program at Norman Wells, using the native-owned Shehtah Drilling to drill 33 additional wells during 1987.

Except for four foreign personnel working on dredges in the Beaufort Sea, all employees in the oil and gas industry were Canadian; 30 per cent were Northerners.

The year 1987 was a turning point for benefits potential in the North; several companies announced new work programs, indicating a renewed interest in northern exploration and development.

East Coast Developments

In March, Petro-Canada announced that it would begin delineation of its 1984 discovery at Terra Nova. This news provided an excellent backdrop for the conference sponsored by the Newfoundland Ocean Industries Association, Newfoundland Offshore: Challenges for the Next Twenty Years, which focused on the economic exploitation of smaller offshore fields like Terra Nova which could use floating production systems.

Drilling and related activity continued steadily on the Grand Banks, and employment ranged from 300 to 450 people. Employment peaked between June and September when two rigs were active; 97 per cent of the workers were Canadian, 62 per cent were Newfoundlanders.



There was drilling in the Nova Scotia offshore between April and August. Employment ranged from 250 to 300 people, with peak employment occurring in May; 98 per cent of the work force was Canadian and 54 per cent Nova Scotian. This relatively low Nova Scotian rate is attributed to a drilling unit originating in Newfoundland and operated by Canadians from that province. Related activities created additional employment opportunities.

Brian Gaudet of Fort Franklin working on Shehtah Rig #2 at Norman Wells. Shehtah was incorporated in June 1983 as a joint venture of the Dene/Métis-owned company Deh Cho Drilling Ltd. and Esso Resources Canada Ltd. In 1987 it acquired a second service rig, and now has a drilling rig, two service rigs and 45 (primarily native) employees. More than 70 per cent of the employees are northerners and the new rig will increase the percentage. Shehtah has displayed excellent technical skill by drilling the world's longest known horizontal well: 1283 metres of the 1900-metre total length are horizontal. Courtesy Esso Resources Canada Limited.

Employment and Industrial Benefits

Canadian Market Opportunities Program

The Canadian Market Opportunities Program (CMOP) represents petroleum industry suppliers, buyers, contractors, consultants and associations. The program aims to increase the participation of Canadian suppliers in petroleum activities and to encourage development of domestic sources of supply for goods and services not currently provided by Canadians. Regional chapters throughout the country are carrying out CMOP objectives. The Atlantic chapter, one of the most active, has representatives from the Newfoundland Ocean Industries Association and the Offshore Trade Association of Nova Scotia, who are also directors on the national board.

At the CMOP annual meeting in Toronto, Gulf presented its purchasing and development plans for the Amauligak project, and Petro-Canada presented its plans for Terra Nova. These types of presentations offer Canadian suppliers and entrepreneurs early information on opportunities for business development.

Industry Initiatives

Under the lead of the Offshore Trade Association of Nova Scotia and with federal and provincial support, a dozen Nova Scotian suppliers undertook a trade mission to the United Kingdom, where North Sea development has opened up construction activities. The delegation visited fabrication yards in England and Scotland.

1987 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total Work Force*	Canadian	Proportion Canadian (%)
Mainland Territories (Yukon and N.W.T.)	331	331	100
Mackenzie Delta and Beaufort Sea	652	648	99.4
Arctic Islands and Eastern Arctic Offshore	93	93	100
Grand Banks and Labrador Sea	516	496	96.1
Nova Scotia Offshore	445	435	97.8
Total	2 037	2 003	98.3

* Approximate number of jobs created.

1987 PETROLEUM EXPENDITURES ON FRONTIER LANDS

	Exploration*	Development	Production (\$million)	Total	Canadian	Proportion Canadian**
Mainland Territories (Yukon and N.W.T.)	6.8	27.0	30.5	64.3	60.4	94.0
Mackenzie Delta and Beaufort Sea	108.8	—	—	108.8	87.0	80.0
Arctic Islands and Eastern Arctic Offshore	8.3	—	0.5	8.8	7.9	90.0
Grand Banks and Labrador Sea	200.0***	—	—	200.0	118.0	59.0
Nova Scotia Offshore	35.5	—	—	35.5	20.1	57.0
Total	359.4	27.0	31.0	417.4	293.4	70.3

* Includes geophysical expenditures. ** Historical estimates. *** Estimate.

Regional Statistical Summary

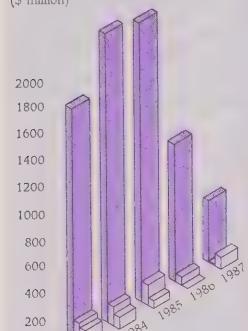
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Frontier Lands

Statistical Summary

Petroleum Expenditures on Frontier Lands

1983-1987
(\$ million)



- Exploratory/Delineation/Development Drilling
- Geophysical Work
- Production Facilities

ACTIVITY STATUS ON FRONTIER LANDS

	1983	1984	1985	1986	1987
Exploration Licences/Agreements Concluded	73	47	5	23	42
Wells Spudded	95	120	99	60	48
Metres Drilled	187 969	241 298	207 896	150 404	67 234
Wells Terminated	90	123	103	70	50
Significant Discoveries	5	11	15	14	1
Rig-Months	195	236	199	133	41
Geophysical Programs Run km Shot	84	65	55	15	7
	106 749	63 817	57 091	11 001	2 756*

* Includes 2273 km of aeromagnetic data.

FRONTIER LANDS RESOURCE INVENTORY

	OIL*		GAS	
	Discovered (millions of m³)	Potential (millions of m³)	Discovered (billions of m³)	Potential (billions of m³)
West Coast	0	50	0	270
Mainland Territories	37.2	95	20.8	312
Mackenzie Delta and Beaufort Sea	253.2	1 464	302.1	2 151
Arctic Islands and Eastern Arctic Offshore	65.7	873	416.4	3 156
Hudson Bay	0	127	0	88
Grand Banks and Labrador Sea	181.0	1 733	146.8	1 286
Nova Scotia Offshore	22.9**	318	160.9	663
Total	560.0	4 660	1 047.0	7 926

* Includes condensate.

** Mostly condensate with some oil.

OIL AND GAS PRODUCTION ON FRONTIER LANDS

	1983	1984	1985	1986	1987
Oil Production (thousands of m³)					
Norman Wells	169	175	949	1 411	1 531
Bent Horn	—	—	29.5	17.5	34.5
Amauligak	—	—	—	50	—
Panuke	—	—	—	—	3.7
Gas Production (millions of m³)					
Pointed Mountain	181	194	226	205	156
Norman Wells	46	41	227	188	163

Mainland Territories

Statistical Summary

ACTIVITY STATUS	1983	1984	1985	1986	1987
Wells Spudded					
Exploratory/Delineation	4	18	15	14	1
Development	57	67	39	14	35
Total	61	85	54	28	36
Wells Terminated*					
Exploratory/Delineation	3	15	17	14	2
Development	57	69	38	14	36
Total	60	84	55	28	38
Metres Drilled	48 598	80 804	53 924	36 289	31 132
Exploratory/Delineation	3 608	28 769	23 968	24 401	974
Development	44 990	52 035	29 956	11 888	30 158
Geophysical Programs Run	12	20	17	7	5
km Shot	2 720	5 371	5 819	2 095	2 422**

* In the mainland territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be reentered in the following year for testing.

** Includes 2273 km of aeromagnetic data.



RESOURCES STATUS	1983	1984	1985	1986	1987**
Discovered Resources*					
Gas (billions of m³)	30.5	21.2	21.4	20.3	20.8
Oil (millions of m³)	44.2	52.3	51.0	51.0	37.2
Gas and Oil Production					
Pointed Mountain Gas (millions of m³)	181	194	226	205	156
Norman Wells Gas (millions of m³)	46	41	227	188	163
Norman Wells Oil (thousands of m³)	169	175	949	1 411	1 531

* As reported in previous years.

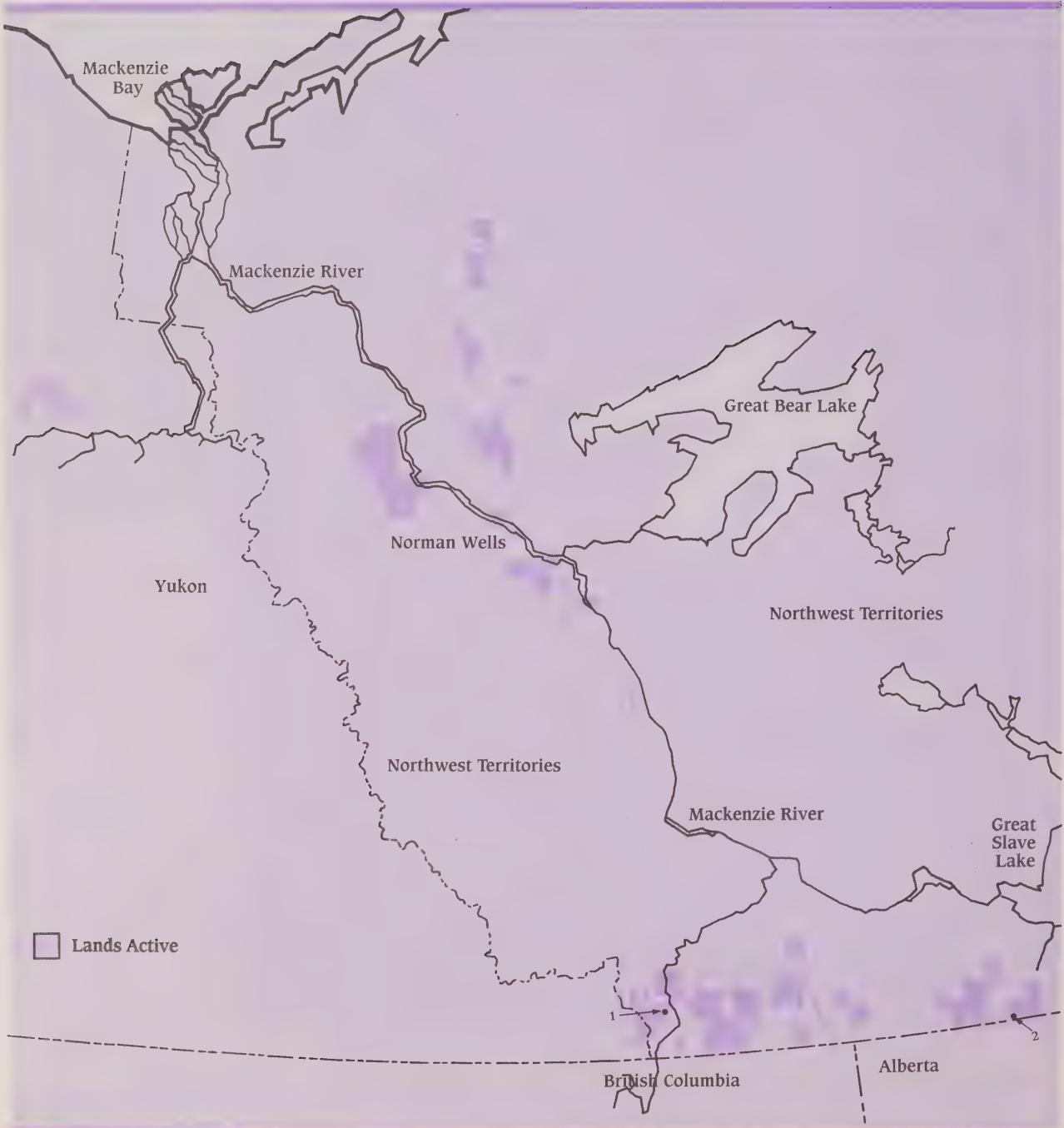
** Includes new discoveries and revisions to previous estimates.

BENEFITS STATUS	1983	1984	1985	1986	1987
Rigs Active	5	14	11	11	3
Rig-Months	27	47	31	33	13
Money Spent (\$M)					
Geophysical	26.3	48.2	60.0	11.1	2.4
Exploratory/Delineation Drilling	12.5	49.5	69.3	54.1	4.4
Development Drilling	24.9	72.1	35.2	14.3	27.0
Production Facilities	159.8	86.1	23.5	5.6	30.5
Total	223.5	255.9	188.0	85.1	64.3

LAND STATUS	1983	1984	1985	1986	1987
Exploration Licences (ELs) Concluded	27	7	0	0	24
Total ELs Active*	27	34	34	30	29
Lands Negotiated into ELs (millions of ha)	7.4	1.4	0	0	4.5
Lands Relinquished/Surrendered (millions of ha)	N/A	0.1	3.1	3.3	4.7
Lands Active* (millions of ha)	13.7	12.3	9.2	5.7	2.3

* Includes declared significant discovery areas.

Mainland Territories



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Northcor et al. Liard F-25A	60°24'22"N 123°35'08"W	Bawden 33	86-08-05 87-02-25	Plugged & suspended, gas discovery	3 478
2.	Petro-Canada N. Cameron Hills C-24	60°03'12"N 116°50'03"W	Tri-City 12	87-08-26 87-09-14	Plugged & abandoned	974

In 1987 abandonment operations were completed for the Texaco Bovie Lake J-72 well.

Mackenzie Delta and Beaufort Sea

Statistical Summary



ACTIVITY STATUS	1983	1984	1985	1986	1987
Wells Spudded Exploratory/Delineation	11	6	19	17	3
Wells Terminated* Exploratory/Delineation	4	12	16	24	3
Metres Drilled Exploratory/Delineation	37 381	31 682	48 370	48 016	8 344
Geophysical Programs Run km Shot	9 7 684	13 7 959	8 4 700	5 4 756	1 139

*In the Beaufort Sea, where operations are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

RESOURCES STATUS	1983	1984	1985	1986	1987**
Discovered Resources*					
Gas (billions of m ³)	286.5	279.5	284.2	292.8	302.1
Oil (millions of m ³)	133.0	130.4	183.1	193.2	253.2

Oil Production Amauligak (thousands of m ³)	—	—	—	50.4	—
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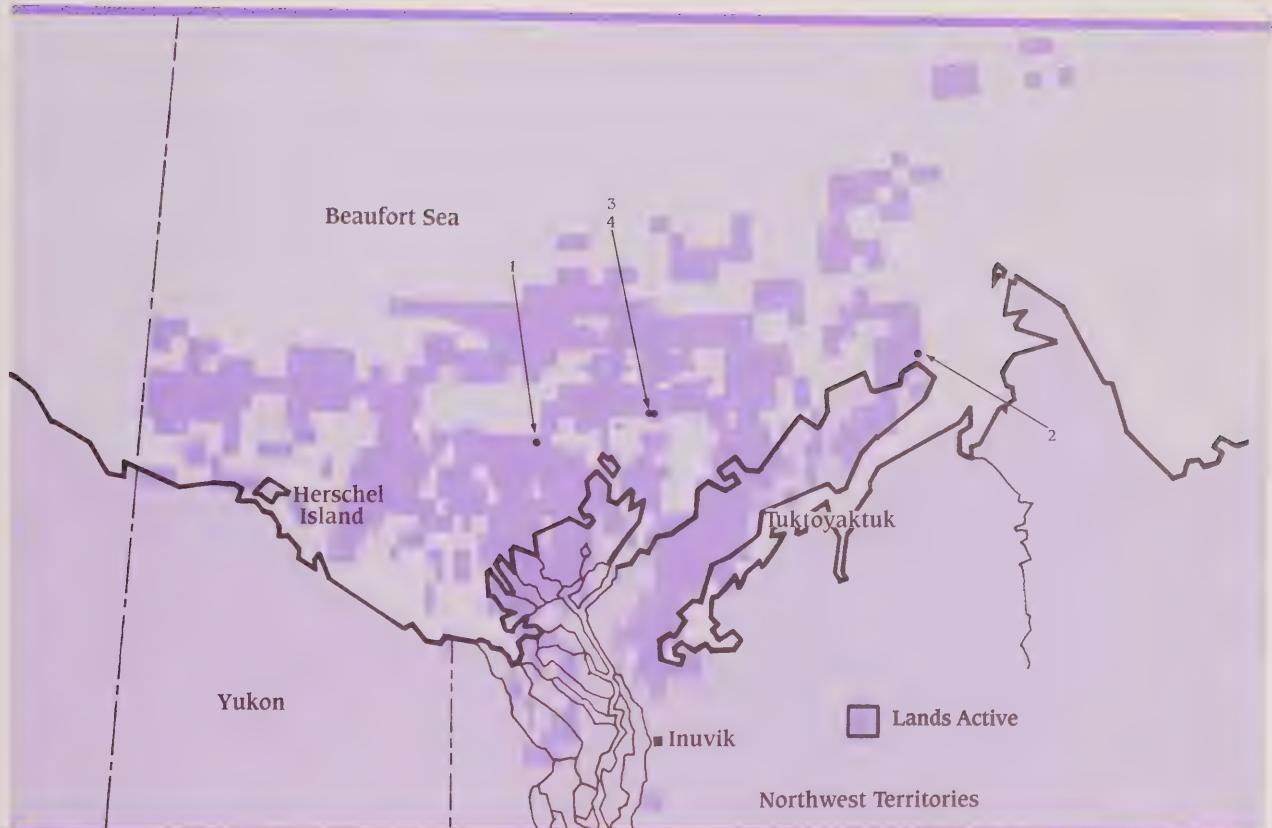
*As reported in previous years.

**Includes new discoveries and revisions to previous estimates.

BENEFITS STATUS	1983	1984	1985	1986	1987
Rigs Active	9	11	13	11	3
Rig-Months	31	39	43	43	5
Money Spent (\$M)					
Geophysical	28.1	27.2	38.4	14.6	0.2
Exploratory/Delineation Drilling	629.8	786.4	760.5	391.5	108.6
Total	657.9	813.6	798.9	406.1	108.8

LAND STATUS	1983	1984	1985	1986	1987
Exploration Licences (ELs) Concluded	9	9	0	0	11
Total ELs Active*	15	24	23	23	28
Lands Negotiated into ELs (millions of ha)	6.8	1.8	0	0	2.1
Lands Relinquished/Surrendered (millions of ha)	N/A	0.3	1.6	3.1	1.4
Lands Active* (millions of ha)	9.2	8.9	7.3	4.2	2.9

*Includes declared significant discovery areas.



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Esso Home et al. Kaubvik 1-43	69°52'33"N 135°25'19"W	SCRI Esso Rig 3	86-10-22 87-01-10	Plugged & abandoned	3 323
2.	Trillium Esso Chevron Angasal L-03	70°12'44"N 129°32'50"W	Esso Rig 2	87-02-24 87-04-12	Plugged & abandoned	2 334
3.	Gulf et al. Amauligak F-24 (Amauligak delineation)	70°03'17"N 133°37'48"W	Molikpaq	87-10-01 87-12-18	Plugged & suspended	5 260
4.	Gulf et al. Amauligak 2F-24 (Amauligak delineation)	70°03'17"N 133°37'48"W	Molikpaq	87-12-22	Drilling	750

Arctic Islands and Eastern Arctic Offshore

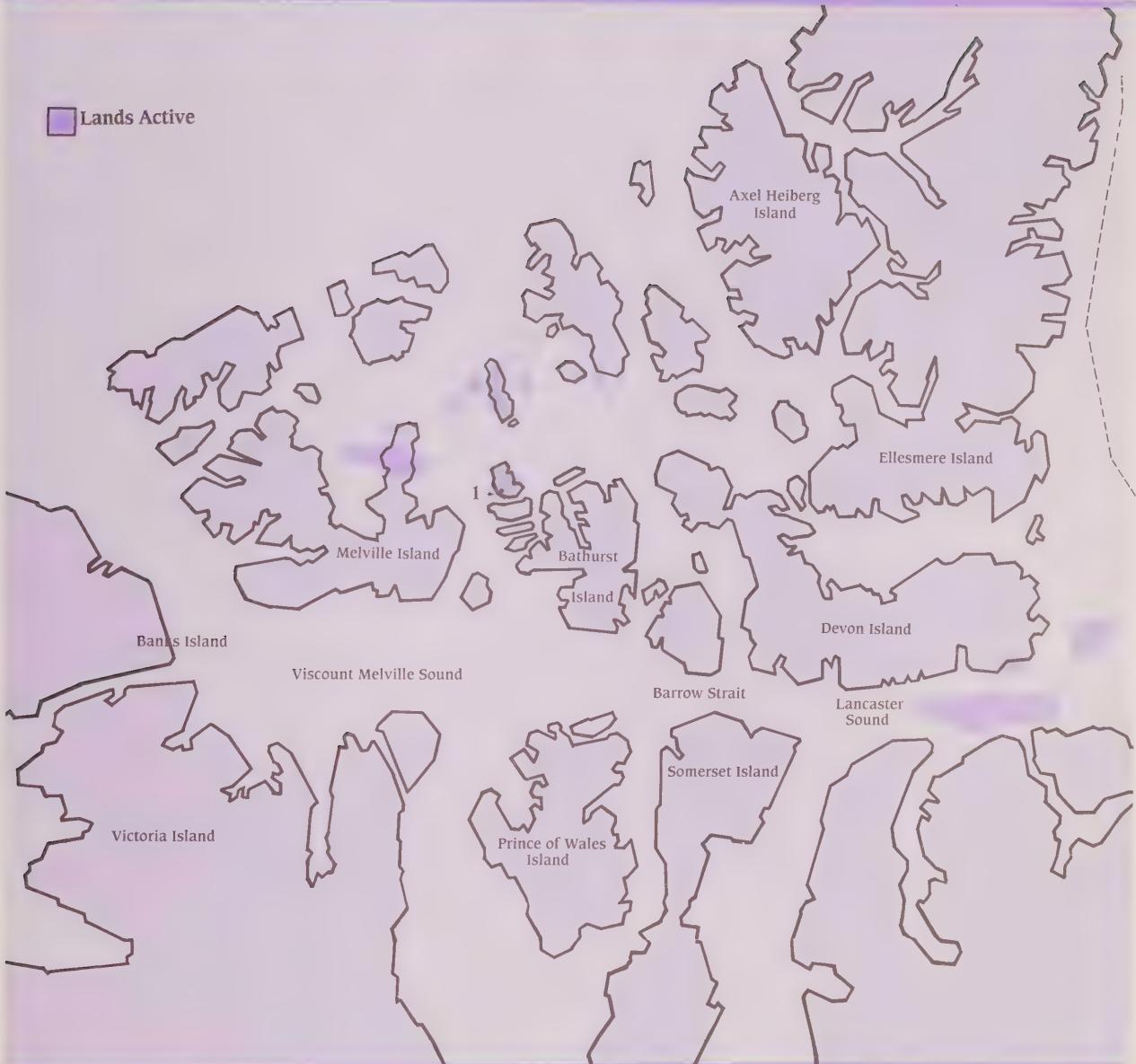
Statistical Summary



ACTIVITY STATUS	1983	1984	1985	1986	1987
Wells Spudded Exploratory/Delineation	4	3	3	2	1
Wells Terminated Exploratory/Delineation	5	4	3	2	1
Metres Drilled Exploratory/Delineation	12 087	11 007	6 185	4 940	689
Geophysical Programs Run km Shot	2	1	0	0	0
	1 142	601	0	0	0
RESOURCES STATUS	1983	1984	1985	1986	1987**
Discovered Resources*					
Gas (billions of m³)	372.2	390.1	415.7	416.4	416.4
Oil (millions of m³)	76.1	49.3	65.7	65.7	65.7
Oil Production Bent Horn (thousands of m³)	—	—	29.5	17.5	34.5
* As reported in previous years.					
** Includes revisions to previous estimates.					
BENEFITS STATUS	1983	1984	1985	1986	1987
Rigs Active	4	4	3	2	1
Rig-Months	17	13	9	4	2
Money Spent (\$M)					
Geophysical	6.2	4.6	0.2	0	0
Exploratory/Delineation Drilling	67.8	64.0	48.0	34.5	8.3
Production Facilities	0	0	7.8	0.6	0.5
Total	74.0	68.6	56.0	35.1	8.8
LAND STATUS	1983	1984	1985	1986	1987
Exploration Licences (ELs) Concluded	0	3	1	1	3
Total ELs Active*	21	24	25	21	16
Lands Negotiated into ELs (millions of ha)	0	1.5	0.7	0.9	0.3
Lands Relinquished/Surrendered (millions of ha)	N/A	0.9	1.4	8.9	5.9
Lands Active* (millions of ha)	17.3	15.8	15.1	7.5	1.6

* Includes declared significant discovery areas.

 Lands Active



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Panarctic et al. Bent Horn F-72B	76°21'27"N 103°58'15"W	Panarctic Rig C	87-10-25 87-12-12	Plugged & suspended	3 278

In 1987 abandonment operations were completed for the Panarctic Bent Horn F-72A well.

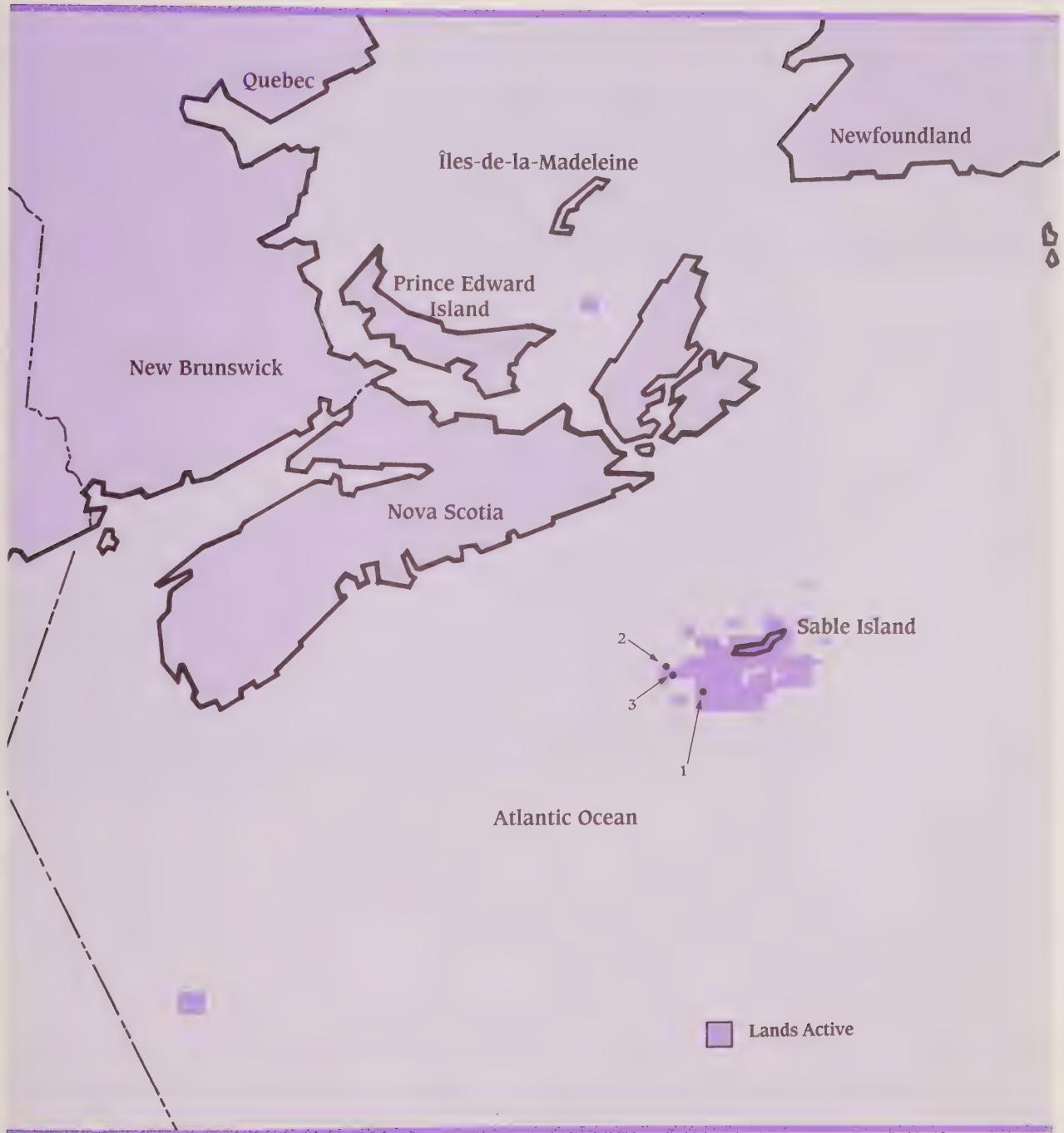
Nova Scotia Offshore

(includes the Gulf of St. Lawrence)

Statistical Summary



ACTIVITY STATUS	1983	1984	1985	1986	1987
Wells Spudded Exploratory/Delineation	12	14	10	6	3
Wells Terminated Exploratory/Delineation	11	13	14	8	3
Metres Drilled Exploratory/Delineation	60 088	71 046	47 064	29 744	9 583
Geophysical Programs Run km Shot	38	17	14	2	1
	38 495	21 587	26 814	613	195
RESOURCES STATUS	1983	1984	1985	1986	1987**
Discovered Resources*					
Gas (billions of m³)	108.7	122.6	127.4	150.6	160.9
Condensate and Oil (millions of m³)	13.7	16.7	20.0	22.1	22.9
Oil Production Panuke (thousands of m³)	N/A	N/A	N/A	N/A	3.7
* As reported in previous years.					
** Includes new discoveries and revisions to previous estimates.					
BENEFITS STATUS	1983	1984	1985	1986	1987
Rigs Active	9	10	8	5	2*
Rig-Months	72	83	50	22	5
Money Spent (\$M)					
Geophysical	50.5	23.2	29.2	0.9	0.2
Exploratory/Delineation Drilling	579.4	594.7	452.0	176.8	35.3
Total	629.9	617.9	481.2	177.7	35.5
* One rig worked off both Nova Scotia and Newfoundland.					
LAND STATUS	1983	1984	1985	1986	1987
Exploration Agreements (EAs) Concluded	5	15	2	13	3
Total EAs Active*	25	30	28	15	17
Lands Negotiated into EAs (millions of ha)	0.5	10.5	0.9	1.7	0.3
Lands Relinquished/Surrendered (millions of ha)	1.6	8.5	2.8	3.2	1.1
Lands Active* (millions of ha)	20.0	6.3	4.2	1.1	0.7
* Includes declared significant discovery areas.					



Nova Scotia Offshore (including the Gulf of St. Lawrence)

Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Canterra et al. Whycocomagh N-90	43°39'51"N 60°28'04"W	<i>Sedco 710</i>	87-04-20 87-05-26	Plugged & abandoned	3 536
2.	Petro-Canada et al. Como P-21	43°50'46"N 60°48'19"W	<i>Rowan Gorilla I</i>	87-05-14 87-06-29	Plugged & abandoned	3 540
3.	Petro-Canada et al. Panuke F-99 (Panuke delineation)	43°48'25"N 60°44'34"W	<i>Rowan Gorilla I</i>	87-07-02 87-08-24	Plugged & suspended, oil	2 507

Appendix

Newfoundland Offshore

(1986 and 1987 data verified by the Canada-Newfoundland Offshore Petroleum Board)

Statistical Summary

ACTIVITY STATUS	1983	1984	1985	1986	1987
Wells Spudded Exploratory/Delineation	7	12	11	7	5
Wells Terminated Exploratory/Delineation	10	10	13	8	5
Metres Drilled Exploratory/Delineation	29 815	46 759	49 098	31 415	17 486
Geophysical Programs Run km Shot	21 48 261	12 27 808	16 19 758	1 3 537	0 0



* As reported in previous years.

** Includes new discoveries and revisions to previous estimates.

BENEFITS STATUS	1983	1984	1985	1986	1987*
Rigs Active	9	9	8	6	2*
Rig-Months	48	54	63	31	16
Money Spent (\$M) Geophysical Exploratory/Delineation Drilling	57.4 436.9	27.8 485.9	27.3 630.0	4.1 347.0	0 200**
Total	494.3	513.7	657.3	351.1	200**

* One rig worked off both Newfoundland and Nova Scotia.

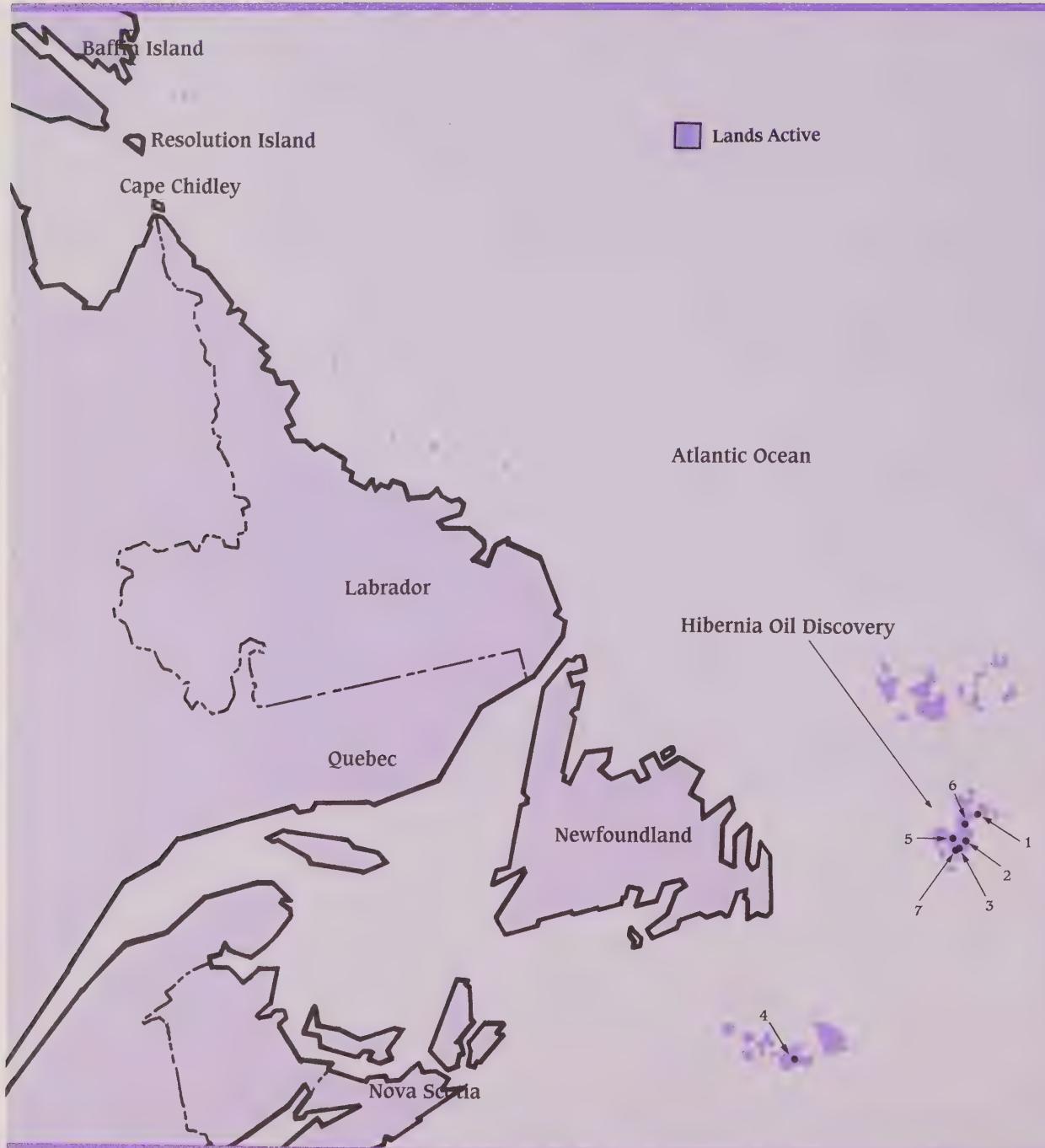
** Estimate.

LAND STATUS	1983	1984	1985	1986	1987
Exploration Licences (ELs) Concluded	32	13	0	9	1
Total ELs Active*	32	41	38	27	21
Lands Negotiated into ELs (millions of ha)	10.3	6.0	0	1.5	0.1
Lands Relinquished/Surrendered (millions of ha)	N/A	8.6	10.9	9.2	1.8
Lands Active* (millions of ha)	24.6	22.0	11.9	3.4	1.7

* Includes declared significant discovery areas.

Newfoundland Offshore

(1986 and 1987 data verified by the Canada-Newfoundland Offshore Petroleum Board)



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	HBV et al. Golconda C-64	46°53'12"N 47°39'57"W	Bow Drill 3	86-10-05 87-02-01	Plugged & abandoned	4 451
2.	HBV et al. Bonne Bay C-73	46°32'11"N 48°11'31"W	Bow Drill 3	87-02-04 87-07-17	Plugged & abandoned	4 205
3.	Petro-Canada et al. Terra Nova H-99 (Terra Nova delineation)	46°28'29"N 48°28'50"W	Sedco 710	87-06-13 87-07-03 87-10-02 87-12-05	Plugged & suspended, oil	3 510
4.	Northcor et al. Narwhal F-99	44°18'22"N 53°44'35"W	Sedco 710	87-07-17 87-09-23	Plugged & abandoned	4 585
5.	HBV et al. North Ben Nevis M-61 (North Ben Nevis delineation)	46°40'54"N 48°25'19"W	Bow Drill 3	86-01-09 86-03-31 87-07-20 87-08-17	Plugged & abandoned, oil and gas	3 422
6.	HBV et al. Whiterose E-09 (Whiterose delineation)	46°48'26"N 48°01'23"W	Bow Drill 3	87-08-20 87-11-11	Plugged & suspended	3 811
7.	Petro-Canada et al. Terra Nova C-09 (Terra Nova delineation)	46°28'10"N 48°30'58"W	Sedco 710	87-12-13	Drilling	592

Glossary of Terms

Abandoned Well: Any well that has been permanently plugged.

Benefits Plan: A plan submitted by operators and approved by the Minister that states the employment and procurement intentions of operators related to their exploration and development activities on frontier lands.

Berm: A submerged artificial island constructed from dredged material and designed to form a base for bottom-founded mobile structures.

Completed Well: A well that has been drilled and equipped so that it is capable of producing oil or gas.

Cubic Metre of Gas: Equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.

Cubic Metre of Oil: Equivalent to 6.2898 American stock tank barrels.

Delineation Well: A well drilled as a follow-up, or extension to a significant discovery on the same geological feature, with the purpose of determining the extent and commercial potential of the oil or gas accumulation encountered in the discovery well.

Development Plan: A plan describing the wells and other facilities proposed to develop a field.

Drillstem Test: A test involving temporary completion of a well to evaluate fluid flow rates and to collect fluid samples.

Dry Hole: A well that has failed to find significant amounts of oil or gas.

Exploration Licence: A licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a Production Licence subject to compliance with the other provisions of the Canada Petroleum Resources Act (formerly called an Exploration Agreement under the Canada Oil and Gas Act).

Exploratory Well: A well drilled on a geological feature where no significant discovery has previously been made (synonymous with wildcat well).

Extended Flow Test: A prolonged drillstem test.

Floating Production System: A floating platform equipped to receive oil or gas through flowlines from offshore wells.

Formation Testing: The gathering of data on a formation to determine its potential productivity.

Geopressure: Abnormally high pressure exerted by some subsurface formations.

Hectare (ha): 10 000 square metres (equivalent to 2.47 acres).

Hydrocarbon: A naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.

Ice Platform: A specially thickened platform made of ice which supports a conventional land drilling rig thereby enabling a well to be drilled in deep water between arctic land masses.

Infill Drilling: Drilling of wells between existing wells to better exploit the reservoir.

Injection Well (Injector): A well in which fluids have been injected into an underground formation to increase reservoir pressure.

Miscible Flooding: Method of enhanced recovery in which various hydrocarbon solvents or gases are injected into the reservoir to help displace oil from the reservoir rock.

Mobile Arctic Caisson: An annular steel caisson (better known as the *Molikpaq*), with deck dimensions of 75 m × 73 m, which is designed to be set down on an underwater berm.

Mobile Offshore Drilling Unit (MODU): Any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.

Reflection Seismic: The primary geophysical technique used in petroleum exploration for mapping subsurface geophysical features. Acoustic pulses are created at the surface and then the pulses reflected from layers of different acoustic properties within the earth are measured.

Rights Issuance: The granting of a licence, usually exploration, on frontier or Crown reserve lands.

Screening Statement: Preliminary outline of environmental issues and possible impacts associated with hydrocarbon projects.

Semisubmersible: A MODU that is stabilized by ballasting its pontoons (base) and columns to a predetermined depth during drilling operations. Used extensively in rough seas and deep waters.

Significant Discovery: A discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and suggests the existence of an accumulation that has potential for sustained production.

Spud: To start the drilling of a well.

Suspended Well: A well in which drilling or production operations have temporarily ceased.

Terminated Well: A well that has reached total depth and has been abandoned, completed or suspended.

Waterflood: A method of recovery in which water is injected into a reservoir to remove additional quantities of oil from the reservoir.

COGLA Offices

Region	Mailing Address	Street Address	Telephone	Telex	Telecopier
Headquarters	15th Floor, Tower B 355 River Road Vanier, Ontario K1A 0E4	14th Floor, Tower B 355 River Road Vanier, Ontario	(613)993-3760	053-4366	993-9897
Maritimes	2000 Barrington Street Suite 102 Halifax, Nova Scotia B3J 3K1	Cogswell Tower, Scotia Square 2000 Barrington Street Suite 102 Halifax, Nova Scotia	(902)426-8570	019-23632	426-5253
	COGLA Laboratory P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2	Bedford Institute of Oceanography, Dartmouth, Nova Scotia	(902)426-3179 (902)426-2525	—	—
Northwest Territories	P.O. Box 1500 Yellowknife, N.W.T. X1A 2R3	Bellanca Building 4914-50th Street 6th Floor Yellowknife, N.W.T.	(403)920-8175	034-45570	873-8707
Western	P.O. Box 2638 Station M Calgary, Alberta T2P 3C1	3rd Floor Merland Building 630-4th Ave. SW Calgary, Alberta	(403)292-5631	—	—

Canada



Energy, Mines and
Resources Canada
Indian and Northern
Affairs Canada

Énergie, Mines et
Ressources Canada
Affaires indiennes
et du Nord Canada

CAI
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The Canada Oil and Gas Lands Administration

Annual Report
1988

Corporate Profile



The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a memorandum of understanding between the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development.

COGLA is the Government of Canada's principal contact with the oil and gas industry in matters relating to the regulation of oil and gas activity on Canada's frontier lands. These lands include Yukon Territory, the Northwest Territories, Hudson Bay and most of the country's offshore areas. The Canada-Newfoundland Offshore Petroleum Board has operational responsibility for the Newfoundland and Labrador offshore. A new Canada - Nova Scotia Offshore Petroleum Board with operational responsibility for the Nova Scotia offshore will be established on proclamation of legislation implementing the Canada - Nova Scotia Accord.

COGLA's prime responsibility is the regulation of the exploration for and the development and production of oil and gas on frontier lands in a manner that promotes safety of the worker, effective resource conservation, protection of the environment, and full and fair access by Canadians to the benefits arising from activities related to hydrocarbon resources.

COGLA has five branches:

- Rights Management Branch
- Engineering Branch
- Resource Evaluation Branch
- Environmental Protection Branch
- Policy Analysis and Coordination Branch

COGLA's regional office in Halifax has operational responsibility for the Nova Scotia offshore; the Yellowknife office has similar responsibilities in the North. These offices regulate the Canada Benefits, and the geological and engineering aspects of oil and gas exploitation activities by issuing authorizations to drill wells, monitoring reports and other data submitted on operations, and conducting regular on-site inspections.



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Message from the Minister of Energy, Mines and Resources, the Honourable Jake Epp



Minister Jake Epp

I am pleased to submit to Parliament the seventh annual report of the Canada Oil and Gas Lands Administration (COGLA), the organization created in 1981 to regulate oil and gas exploration, development and production activities on Canada's frontier lands. COGLA continues to play an important role in implementing this government's Frontier Energy Policy and in ensuring that offshore petroleum activities are carried out in a manner that promotes the safety of workers and the protection of the environment.

This was a significant year for Canada and the Newfoundland offshore in particular. In July the governments of Canada and of Newfoundland and Labrador signed a statement of principles with Mobil Oil Canada Ltd. and its partners on the development of the Hibernia oil field. The Hibernia statement of principles, like the Atlantic Accord, confirms this government's belief that significant economic rewards can be achieved when provinces are treated as equal partners in Confederation. The importance of Hibernia lies not only in bringing on stream future oil supplies or in the number of jobs it will generate, but in the opportunity for Canadians and Newfoundlanders to acquire expertise in offshore technology and in the management of major offshore projects. The federal government supports this project because it will provide unique opportunities for our offshore energy industry to expand and compete for future offshore projects in Canada and throughout the world. Hibernia is an investment in our future. I am happy to report as well that survey contracts have already been awarded to Canadian companies and that bids on major project contracts have been invited.

In June an environmental action plan was released, which maps my department's approach to the important issue of making exploration, development and use of our energy resources compatible with the protection of our environment. COGLA, as the regulatory agency responsible for the exploration and development of our offshore oil and gas resources, plays an important role in developing regulations, standards and guidelines for environmental protection. Many of COGLA's standards and guidelines are internationally recognized. In addition, the independent offshore oil and gas boards established under the East Coast accords incorporate environmental concerns into their deliberations. These include assessments of potential impacts on marine and coastal flora and fauna, proposed oil-spill counter measures and waste-treatment technologies, as well as the potential effects of the weather, the ocean and ice on the safety of offshore operations.

The Canada - Nova Scotia Accord implementation legislation received royal assent in 1988 and steps were taken to have a new independent offshore petroleum board in place when the legislation becomes law. The legislation also incorporates amendments to implement the decision taken in April 1988 by the governments of Canada and of Nova Scotia to place a moratorium on oil and gas exploration on Georges Bank until the year 2000.

The legislation provides for a future public review by an independent panel on the environmental and socioeconomic impacts of petroleum exploration on Georges Bank.

Operators continued their successful delineation programs at the Terra Nova and Whiterose oil discoveries. Petro-Canada awarded a contract in April to SNC/AKER to carry out a preliminary engineering study to evaluate alternative development scenarios for the Terra Nova field. These encouraging developments are promising signs of what is to come in the years ahead for Canada and the Newfoundland offshore.

I remain hopeful for the future of the Nova Scotia offshore. We know that the oil and gas resources are there and that in time these resources will be developed for the benefit of Nova Scotians and all Canadians.

I was pleased to note that the enhanced safety regulations, developed by COGLA in response to the recommendations made by the Royal Commission on the *Ocean Ranger* Marine Disaster, contributed to the safe evacuation of the 27 men and women from the *Rowan Gorilla 1* drilling unit when it sank in the North Atlantic in early December. The crew of the drilling unit praised the training they had received while working offshore Nova Scotia for saving their lives.

I firmly believe that oil and gas policies initiated by this government will continue to be an important driving force in the development of Canada's regional economies.

Jake Epp

Message from the Minister of Indian Affairs and Northern Development, the Honourable Pierre H. Cadieux



I am happy to join my colleague the Honourable Jake Epp, Minister of Energy, Mines and Resources, in submitting to Parliament the seventh annual report of the Canada Oil and Gas Lands Administration.

In 1988 the federal government reinforced its commitment to promote political and economic development in the North when it signed separate agreements-in-principle (AIPs) on a Northern Accord with the governments of the Northwest Territories and Yukon. These agreements honor the pledge made by the government in the Frontier Energy Policy of 1985 and again in the Northern Political and Economic Framework of 1987. Final agreements on a Northern Accord would transfer to the territories the administrative and legislative powers to manage oil and gas resources in the northern onshore areas and would provide for joint management of the offshore areas.

Another facet of the government's Northern Political and Economic Framework has been to settle native land claims. In 1988 we continued to implement the 1984 final agreement with the Inuvialuit of the Western Arctic. In September an AIP was signed to settle the Dene-Métis land claim in the western Northwest Territories. The government also ratified an AIP with the Council of Yukon Indians in March 1989.

The AIP on a Northern Accord, land claims and other similar agreements will, over time, significantly change the current process of regulating oil and gas exploration and development activities in the North. The critical challenge facing governments, Northerners and industry will be to continue fostering the spirit of cooperation now in place as we move from the existing oil and gas management and regulatory regime to a new regime which will be created upon full implementation of accord arrangements and claim settlements. This new regime will create a climate of greater certainty, stability and opportunity for the oil and gas industry in the North.

Although the number of exploratory wells in the North in 1988 was slightly less than last year, geophysical activity increased dramatically, with a trend toward three-dimensional site surveys. This indicates that industry remains interested in exploring and developing the North's hydrocarbon potential.

Panarctic continued seasonal production at the Bent Horn oil production facility in the Arctic Islands. The company sent two shipments of oil to northern and southern markets. Part of one shipment was dropped off at Resolute for use by the Northwest Territories Power Corporation.

Gulf continued its delineation program at the Amauligak discovery. Commercial development of this significant discovery will depend on many economic factors, including oil prices. The operator and its partners continue to examine conceptual engineering for field development and pipeline construction.

Esso and Shell submitted applications to the National Energy Board (NEB) for export licences to produce and export gas via a pipeline from existing discoveries in the Mackenzie Delta-Beaufort Sea region to the United States (Gulf submitted a similar application to NEB early in 1989). Public hearings by NEB will be held in 1989 to determine whether export licences should be granted and, if so, under what terms and conditions. Other regulatory approvals will also be required before development and production can proceed.

I believe that this government's Frontier Energy Policy and market-oriented policy with respect to oil and gas exploration and development will continue to bring economic benefits to the North. Our government's role is to continue to work together with territorial governments, industry and Northerners in putting the mechanisms in place to develop the hydrocarbon resources of the North, while ensuring that activities are carried out safely and without harm to the environment.



Minister Pierre H. Cadieux

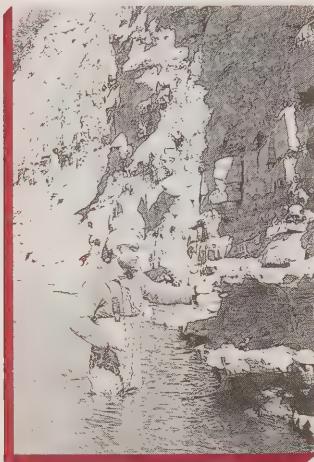


Canada's Frontier Lands

The Kulluk conical drilling unit with a standby vessel during a test of the Amauligak O-86 well in the Beaufort Sea.
Courtesy, B. Gallagher.



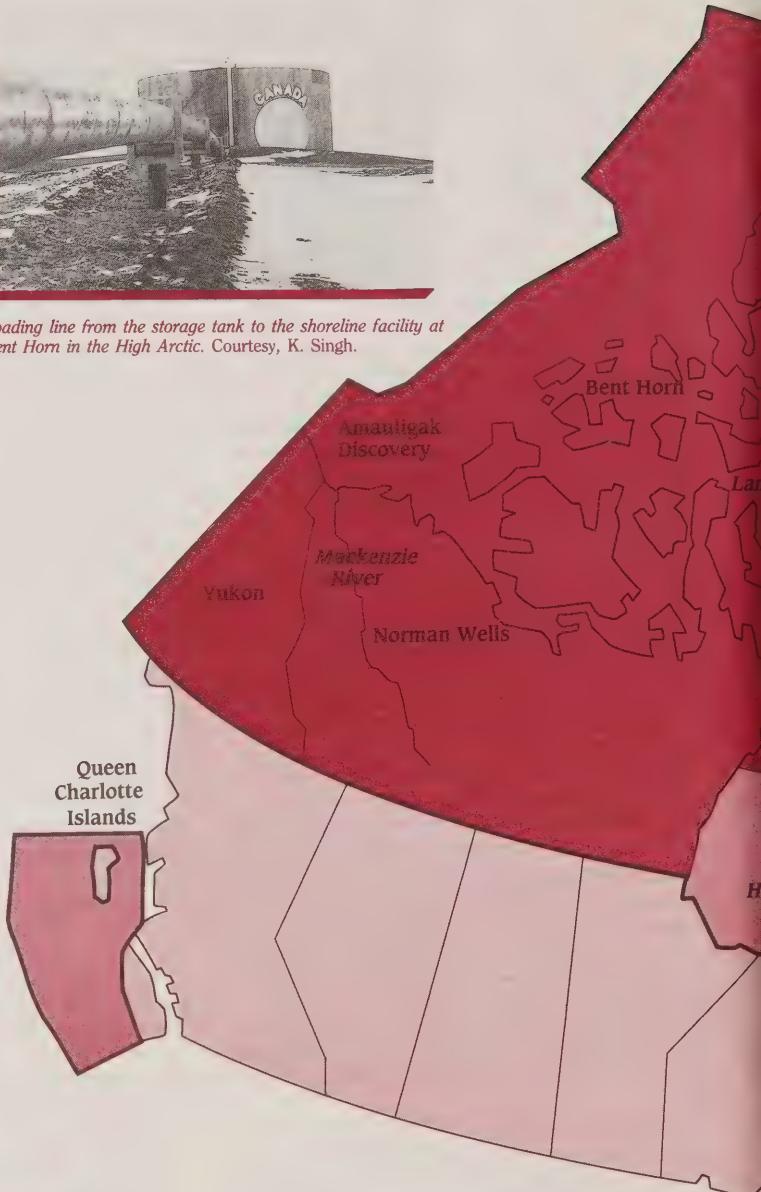
A geologist at work in the Richardson Mountains, northern Yukon.
Courtesy, G. Morrell.



A view of the Pacific Ocean from South Moresby Island, B.C.
Courtesy, U. Schmidt.



Loading line from the storage tank to the shoreline facility at Bent Horn in the High Arctic. Courtesy, K. Singh.



■ Area under the responsibility of the Minister of Energy, Mines and Resources

■ Area under the responsibility of the Minister of Indian Affairs and Northern Development



The Sedco 710 during testing at the Terra Nova oil discovery. Courtesy, Petro-Canada Resources Inc.



The MV Sable Sea, a support vessel used by divers to abandon two suspended Mobil wells on the Scotian Shelf.
Courtesy, Secunda Marine Services Limited.



A Word from COGLA's Administrator, Maurice Taschereau



Mr. Maurice Taschereau

Exploration activity on Canada's frontier lands in 1988 continued at a reduced level because of fairly low oil prices and uncertainty about future prices.

For the past few years, much of COGLA's efforts have been aimed at establishing a frontier resource management regime based on the principles set out in the Frontier Energy Policy. The transition from a centralized approach to a regional and joint management approach is progressing steadily.

Several key initiatives are now in place that have brought much needed stability to the industry operating on the frontier lands. In the Canada Petroleum Resources Act (CPRA), we now have a simplified, competitive and consistent regulatory system for issuing and managing exploration rights on frontier lands — a system that is fair to both industry and Canadians.

The Canada-Newfoundland Offshore Petroleum Board has been responsible for administering and regulating the Newfoundland offshore for the past two years. The board and COGLA have made progress in developing memorandums of understanding with federal and provincial departments. These memorandums ensure coordination in areas such as environment, fisheries, benefits and marine safety. With consent from the Minister of Energy, Mines and Resources, the independent board issued its first call for bids under the new management regime in March 1988. As a result, two exploration licences were issued in November.

The Canada - Nova Scotia Accord implementation legislation received royal assent in 1988. The two governments are now preparing to set up a new independent offshore petroleum board. Once the legislation is proclaimed, the new board will assume legal responsibility for managing the offshore and will replace the current Canada - Nova Scotia Offshore Oil and Gas Board.

The implementing legislation for each of the East Coast accords combines provisions of CPRA and the Oil and Gas Production and Conservation Act (OGPCA). The legislation, therefore, ensures that the regulatory regime in those areas is consistent with regimes in the rest of the frontier lands.

We continue to work closely with the accord provinces, territorial governments, British Columbia, the Canada-Newfoundland Offshore Petroleum Board and the industry to complete proposed amendments to OGPCA, as well as related sections of the implementing legislation for the Atlantic and Canada - Nova Scotia accords. Amendments to the act will enhance existing safety provisions.

The Government of Canada and each of the territorial governments signed agreements in principle on a Northern Accord in September 1988. A Northern Accord will significantly affect the future oil and gas regulatory process in the North. Solving many of the past uncertainties should make the petroleum industry's operating environment more stable and consistent, and renew interest in northern hydrocarbon exploration and development.

During this period of transition and low activity, industry and government must continue laying the groundwork to develop the major discoveries made on frontier lands. To a large extent, this has been accomplished in the Newfoundland offshore with the signing of a statement of principles for developing the Hibernia oil field.

There is much to look forward to. Abundant Crown land is available for issuance of new rights throughout the frontier regions. Over the years, COGLA has collected a wealth of geological and geophysical information and we make it available to industry after the information is released from confidential status. I believe that with more stable oil prices, an increased level of activity is just a matter of time. When that time comes, COGLA and the new independent boards will be ready to meet the demands and challenges.

I would like to take this opportunity to thank the staff at COGLA for their dedication, patience and perseverance during this period of transition.

A red ink signature of Maurice Taschereau's name, "Maurice Taschereau", with a horizontal line underneath.



1988 Highlights

In July the governments of Canada and of Newfoundland and Labrador signed a statement of principles with Mobil and its partners to develop the Hibernia oil field.

In September the Government of the Northwest Territories and the Government of Yukon signed agreements with the Government of Canada on the negotiating principles for a Northern Accord on oil and gas resource management and revenue-sharing.

Parliament passed legislation to implement the Canada - Nova Scotia Offshore Petroleum Resources Accord in July. The Government of Canada and the Government of Nova Scotia are expected to proclaim the accord implementation legislation in 1989. A new independent offshore board will assume the legal responsibility for managing the Nova Scotia offshore on the date the legislation is proclaimed.

During 1988 there were 18 wells active on frontier lands, one more than in 1987. Eight were delineation wells and ten were exploratory wells. Sixteen wells were terminated this year, seven in the North and nine on the East Coast offshore.

The Newfoundland offshore continued to be the most active area of the frontier lands with four delineation and five exploratory wells active in 1988. Petro-Canada continued its successful delineation program at the Terra Nova oil discovery, and Husky delineated its Whiterose discovery.

Gulf completed its current delineation program at the Amauligak oil discovery in the Beaufort Sea. Six delineation wells have been drilled since the Amauligak J-44 discovery of 1984. Recoverable oil reserves at Amauligak are now estimated at more than 79.5 million m³.

Panarctic continued seasonal production and transportation of oil from its Bent Horn development project in the Arctic. There were two tanker shipments of oil, one in August and the other in September. Additional oil was produced and stored at the Bent Horn storage facility in preparation for the 1989 summer shipping season.

The drilling phase of the Norman Wells Expansion Project was completed in 1988. At year-end, a total of 310 wells were active, including 158 producers and 152 injectors. Production at Norman Wells increased to 1.728 million m³ in 1988.

COGLA participated in an assessment of the hydrocarbon potential of the Mackenzie Delta - Beaufort Sea basin with the Institute of Sedimentary and Petroleum Geology in Calgary. As a result of the assessment, oil and gas resources in this basin were estimated at 1.13 billion m³ of oil and 1.9 trillion m³ of natural gas. These estimates are somewhat lower than those previously published.

In April the governments of Canada and Nova Scotia agreed to place a moratorium on exploration activity on Georges Bank off Nova Scotia until the year 2000. An independent panel will conduct a public review of the environmental and socio-economic impacts of oil and gas exploration and drilling on Georges Bank and will report its findings to the ministers of energy for Canada and Nova Scotia on or before 1 July 1999. The moratorium and public review requirements will be incorporated into law through the Canada - Nova Scotia Accord implementing legislation.

The Environmental Studies Management Board was established under the Canada Petroleum Resources Act to advise ministers on the operations of the Environmental Studies Research Funds. The 12 board members represent federal government departments, regional petroleum boards, the oil and gas industry, and the public.

Federal-Provincial-Territorial Management of the Frontier Lands



Prime Minister Brian Mulroney and Northwest Territories Government Leader Dennis Patterson at the signing of the agreement-in-principle on a Northern Accord in Yellowknife on 6 September 1988.

Offshore Accords

The federal government signed offshore accords with the Government of Newfoundland and Labrador in 1985, and with the Government of Nova Scotia in 1986. Under the accords, the provinces have an equal say with the Government of Canada in the legislation and regulation of offshore petroleum activities. The provinces also receive revenues from offshore petroleum activities and production as if the resources were on land.

The East Coast accords incorporate the provisions of the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act. The regulations under each accord implementing legislation correspond closely to those in effect elsewhere on frontier lands. This ensures a consistent regulatory regime in all Canada's offshore areas.

Each accord establishes a new independent board to manage an offshore area on behalf of Canada and the province. The boards regulate offshore activities, although the federal and provincial energy ministers retain authority to review certain fundamental decisions.

Newfoundland and Labrador

The Canada-Newfoundland Offshore Petroleum Board (CNOPB) has formally regulated petroleum activities in the Newfoundland offshore since 4 April 1987, the day the Atlantic Accord implementation legislation was proclaimed. Located in St. John's, Newfoundland, CNOPB publishes its own annual report covering offshore operations during its fiscal year, which ends 31 March.

Through memorandums of understanding, CNOPB coordinates its activities with federal and provincial departments that have a mandate in the offshore. In 1988 memorandums on environmental services, fisheries and ocean-related matters were signed. In November the board conducted its first issuance of new exploration rights under the Canada-Newfoundland Atlantic Accord Implementation Act, awarding exploration licences for two parcels in the vicinity of Hibernia.

In July 1988 the governments of Canada and of Newfoundland and Labrador signed a statement of principles with Mobil and its partners to develop the Hibernia field. Production is scheduled to begin in 1995. As Canada's first commercial offshore oil project on the East Coast, Hibernia will be an important milestone in the history of frontier oil and gas development in Canada.

Nova Scotia

The Government of Canada passed legislation to implement the Canada - Nova Scotia Offshore Petroleum Accord in July 1988. Matching provincial legislation was passed by the Nova Scotia legislature earlier in the year. Both the federal and provincial governments are expected to proclaim the accord implementation legislation in 1989. A new independent board will then assume legal responsibility for managing the offshore on proclamation date.

The existing Canada - Nova Scotia Offshore Oil and Gas Board, established in 1982, continued to regulate the offshore area throughout 1988. Maurice Taschereau, COGLA's administrator, chairs the board. Board decisions and operations fully reflect the joint management principles of the 1986 accord. The current board will carry out its duties until the accord legislation is proclaimed and the new offshore petroleum board assumes responsibility.



Mobil drilled one well, and Shell conducted one well-site seabed survey off Nova Scotia in 1988. As well, Mobil carried out final abandonment and removal of all seafloor material at four of its former drilling sites in the area. Low oil prices have dramatically affected activity in the Nova Scotia offshore; no rigs were active at year-end and industry drilling plans for 1989 remain uncertain.

British Columbia

In 1988 the governments of Canada and British Columbia continued discussions on a Pacific Accord. The prohibitions on offshore petroleum activity, in place since the early 1970s, remained in effect throughout the year. The federal and provincial governments cooperated in following up on many of the recommendations in the *West Coast Offshore Exploration Environmental Assessment Panel Report*. Following its review and extensive public hearings, the panel found that oil and gas exploration could resume safely in the offshore area under stringent conditions and procedures. Most of the report's recommendations were accepted. In October 1988 a progress report on the governments' follow-up work was released.

Northern Accord

In September 1988 the governments of Yukon and the Northwest Territories signed agreements with the Government of Canada on the negotiating principles for a Northern Accord.

The Government of Canada has agreed in principle to negotiate agreements to transfer to the territorial governments the administrative and legislative powers to manage oil and gas resources in the northern onshore area. The agreements in principle also provide for negotiating joint management of the offshore areas in the North. Until the transfer of management is completed, the federal government will consult the territorial governments fully on regulatory decisions.

COGLA's Role in Joint Management

COGLA cooperates closely with the coastal provinces and the territorial governments in carrying out its responsibilities. COGLA plays a lead role in implementing accords by facilitating the transfer of regulatory and management responsibilities, and maintains advisory and coordinating functions after the accords are fully implemented. In geographic areas where accords have not been concluded and passed into law, COGLA manages and regulates offshore petroleum activity in keeping with the joint management principles established in the 1985 Frontier Energy Policy.

Rights Management

COGLA issues, manages, transfers and registers oil and gas exploration and production rights in Canada's North and offshore frontier areas not covered by regional boards, under the authority of the ministers of Indian Affairs and Northern Development, and of Energy, Mines and Resources. COGLA also administers certain federal mineral rights within the provinces on behalf of the Minister of Energy, Mines and Resources.

Frontier Lands

During 1988 COGLA completed work on second terms for those exploration licences in which the initial term had expired. COGLA also developed and implemented forms for the three new types of licences established under the Canada Petroleum Resources Act (CPRA), namely exploration, significant discovery and production licences. The exploration licence replaces the exploration agreement. Twelve exploration licences and one exploration agreement were issued in 1988, providing the interest owners with a second term (generally for four years) to carry out exploration activity. The first year of the second term is rent free, but rentals apply on an increasing scale every year thereafter. Such rentals may be refunded commensurate with allowable expenditures incurred through exploratory work on the lands.

There were 92 significant discovery licences issued in 1988, providing a new title document to holders of rights in areas subject to significant discovery area declarations. As well as maintaining exclusive rights to drill on and to develop the lands to produce petroleum, these licences preserve an interest owner's right to obtain a production licence. Significant discovery licences remain in force as long as the relevant declaration of significant discovery is in force, or until a production licence is issued.

At year-end, the industry held 7.1 million hectares of frontier lands, consisting of 59 exploration agreements and licences, 92 significant discovery licences and 2 production licences. In addition, about 18.5 million hectares are held in areas where exploration is not allowed.

In 1988 Part VIII of CPRA, concerning transfers, assignments and registration, came into effect. On 28 April the Frontier Lands Registration Regulations were enacted, and COGLA set up a public register of petroleum exploration and production interests and instruments. The registration system records the ownership of interests such as exploration licences, significant discovery licences and production licences, as well as certain former exploration agreements, former leases, former permits and claims related to these existing rights. For a fee, the public can review an interest and related documents. A registrar and deputy registrar were appointed within COGLA to perform the registration duties. Since the registry opened, 364 interests and 108 instruments have been registered. This registration system does not include interests held offshore Newfoundland and Labrador.

The Canada-Newfoundland Offshore Petroleum Board (CNOPB) established an identical public register for interests held offshore Newfoundland and Labrador. The Newfoundland Offshore Area Registration Regulations set up the Newfoundland public register on 25 May.

CNOPB issued two licences offshore Newfoundland following a call for bids that closed in September. At year-end CNOPB administered rights held under 9 exploration licences and 10 significant discovery licences.

No new rights were issued in the North or in the Nova Scotia offshore.

At the end of the year, the Canada - Nova Scotia Offshore Oil and Gas Board administered rights held under 15 exploration agreements, which include 19 declared significant discovery areas. In the Georges Bank area a prohibition on exploration was announced until the year 2000.

The Frontier Lands Petroleum Royalty Regulations 1987 were promulgated to provide an interim regime for the payment of frontier royalties. They were also extended at year-end to apply until December 1990. These interim regulations will continue to be in force until more comprehensive regulations, now under development, are enacted.

In 1988 COGLA consulted with industry, the accord provinces, the offshore boards and territorial governments to develop regulations under CPRA on royalties and Canadian ownership, together with guidelines, forms and procedures for surveys.

As well, information on existing rights and the rights issuance process was provided to companies, native groups, land use planning commissions in the North and other interested parties.

Public Lands

In response to requests from industry, tenders were solicited for 125 parcels of oil and gas leasehold rights, located mainly in the western provinces. In October tenders were accepted for 59 parcels, bringing in more than \$1 million in cash bonus revenues.

FRONTIER LAND HOLDINGS AT YEAR-END, 1988	1984	1985	1986	1987	1988
Number of Licences/Agreements Active*	153	150	118	112	153
Lands Negotiated into Licences/Agreements (millions of ha)	21.2	24.9	4.1	7.3	2.31
Lands Relinquished or Surrendered (millions of ha)	24.7	20.6	39.2	15.1	16.5
Lands Active (millions of ha)	89.5	70.8	33.5	20.6	7.1

* Includes exploration licences, exploration agreements, significant discovery licences and production licences.

LAND STATUS AT YEAR-END, 1988

	Active Licences/ Agreements*	Lands Relinquished or Surrendered	Lands Negotiated into Licences/ Agreements	Lands Active	Pending Lands**
		(millions of ha)	(millions of ha)	(millions of ha)	(millions of ha)
Mainland Territories	30	0.9	0.08	1.2	1.1
Mackenzie Delta and Beaufort Sea	59	2.1	1.4	3.4	0
Arctic Islands and Eastern Arctic Offshore	30	0.6	0.4	1.4	2.4
Hudson Bay	0	11.5	0.3	0	1.4
Grand Banks and Labrador Sea	19	1.0	0.1	0.8	1.5
Nova Scotia Offshore (includes Gulf of St. Lawrence)	15	0.4	0.03	0.3	3.4
West Coast	0	0	0	0	8.7
Total	153	16.5	2.31	7.1	18.5

* Includes exploration licences, exploration agreements, significant discovery licences and production licences.

** 'Pending' includes areas where exploration activity has been suspended: West Coast, Baffin Bay, Georges Bank, St. Pierre and Miquelon, etc.

Rights Management

LICENCES/AGREEMENTS NEGOTIATED IN 1988

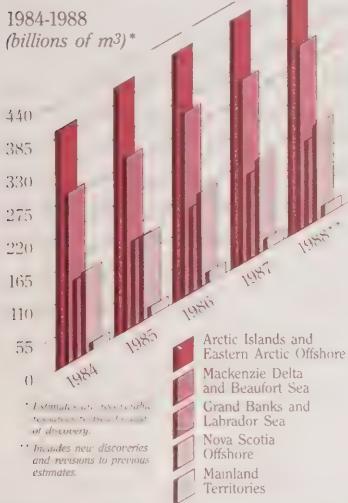
Operating Company	Licence/Agreement	Number of Licences/Agreements*	Area (thousands of ha)	Location	Term (years)
Esso	EL 340-345	6	1 073	Mackenzie Delta/Beaufort Sea	4
Dome	EL 346	1	199	Beaufort Sea	4
Panarctic	EL 347	1	64	Cameron Island	4
Can. Southern	EL 348	1	30	Cameron Island	4
Sogepet	EL 349	1	352	Hudson Bay	4
Canterra	EA 350	1	36	South Sable	3
Amoco	SDL 001-004	4	3	Mackenzie Valley	—
Canterra	SDL 005	1	11	Eastern Arctic	—
Dome	SDL 006	1	7	Mackenzie Valley	—
Paramount	SDL 007-010	4	6	Mackenzie Valley	—
Phillips	SDL 011	1	3	Mackenzie Valley	—
PanCanadian	SDL 012	1	13	Mackenzie Valley	—
Suncor	SDL 013	1	5	Mackenzie Valley	—
Chevron	SDL 014-016	3	2	Mackenzie Delta	—
Shell	SDL 017-019	3	8	Mackenzie Delta	—
Westmin	SDL 020-022	3	12	Yukon	—
Petro-Canada	SDL 023-024	2	29	Mackenzie Valley	—
Suncor	SDL 025-028	4	4	Mackenzie Delta	—
Gulf	SDL 029-036	8	44	Mackenzie Delta	—
Provo Gas	SDL 037	1	8	Beaufort Sea	—
Dome	SDL 038	1	6	Beaufort Sea	—
113967 Ontario	SDL 039	1	12	Beaufort Sea	—
Dome	SDL 040-041	2	15	Beaufort Sea	—
Dome	SDL 042	1	2	Mackenzie Valley	—
Panarctic	SDL 043-046	4	23	Arctic Islands	—
Placid Northern	SDL 047-049	3	13	Beaufort Sea	—
Esso	SDL 050-065	16	65	Mackenzie Delta/Beaufort Sea	—
Dome	SDL 066	1	3	Arctic Islands	—
Panarctic	SDL 067-081	15	306	Arctic Islands	—
Dome	SDL 082	1	14	Eastern Arctic	—
Petro-Canada	SDL 184, 185A&B, 187	4	25	CNOPB	—
Mobil	SDL 195-197, 200	4	37	CNOPB	—
Canterra	SDL 203	1	2	CNOPB	—
Petro-Canada	SDL 208	1	4	CNOPB	—
Petro-Canada	EL 1001	1	54	CNOPB	6
BP Resources	EL 1002	1	58	CNOPB	6

* Includes exploration licences and significant discovery licences.

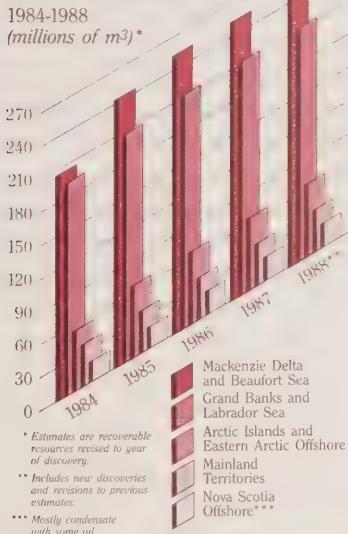
Exploration Activity



Discovered Gas Resources by Region on Frontier Lands



Discovered Oil and Condensate Resources by Region on Frontier Lands



A total of 18 delineation and exploratory wells were active on frontier lands this year. This is a slight increase over last year and halts the recent trend of decreasing drilling activity. Sixteen wells were terminated in 1988, seven in the North and nine on the East Coast offshore. At year-end drilling was under way at one location offshore Newfoundland. Of the 18 wells active in 1988, 8 were delineation wells. This indicates industry's interest in confirming reserves in known discoveries to prepare for eventual production. Of the delineation wells, six contained hydrocarbons. Hydrocarbons were also discovered in two of the ten exploratory wells (Gulf et al Amauligak O-86 and Mobil et al South Sable B-44).

Geophysical activity increased noticeably from last year, with a trend toward three-dimensional or site-specific surveys. This again reflects industry's interest in proving up future drilling locations.

The North

The continued success of both exploratory and delineation drilling in the Amauligak area of the Beaufort Sea highlighted northern exploration.

Beaufort Sea and Mackenzie Delta

The Beaufort Sea continued to be the most important area for exploration activity in the North. Several companies conducted geophysical or geological programs this year. Esso completed three seismic programs, two onshore (including a three-dimensional survey at Taglu) and one offshore. Amoco concluded a regional seismic program, conducted several site-specific high-resolution surveys in the west Beaufort and undertook a large airborne geochemical survey over most of the Beaufort. Geophysical Services Inc. carried out a three-dimensional seismic survey in the offshore, and Gulf did a small electromagnetic survey over a potential pipeline route to Amauligak.

Exploration Activity



Drilling camp for Esso's three-dimensional seismic project at Taglu on the east side of the Mackenzie Delta.
Courtesy, L. Richards.

Four delineation wells and one exploratory well were active in 1988. The delineation wells were all drilled from the east berm location at the Amauligak discovery. Gulf et al Amauligak 2F-24, which began drilling in late 1987, was deviated to the southwest and abandoned without being tested in early 1988. The operator then drilled Gulf et al Amauligak 2F-24A to a location north of 2F-24 and encountered the gas-bearing pay zone in a structurally higher position. Gulf et al Amauligak F-24, which had been drilled to total depth in 1987, was then tested; it flowed oil from several zones at rates up to 1096 m^3 per day. After this well was abandoned, Amauligak 2F-24B was drilled from the 2F-24 well-bore and then deviated to the northeast of the berm. The operator then tested the well and encountered oil from several zones at rates up to 950 m^3 per day.

Only one exploratory well, Gulf et al Amauligak O-86, was drilled at a location just west of the Amauligak field, using the *Kulluk* floating drilling unit. The operator tested the well and discovered hydrocarbons in a fault block completely separated from the main Amauligak discovery and the 1986 West Amauligak oil discovery. The discovery contained oil and gas and, when tested, flowed oil at a rate of up to 1059 m^3 per day.

Mainland Territories

Several companies conducted exploration activities on the Mainland Territories during 1988. Chevron undertook a seismic survey, a geological field survey and an extensive gravity survey in the Fort Good Hope, N.W.T. area. Mobil carried out a small three-dimensional seismic survey in the same area. Both Shell and Petro-Canada conducted seismic surveys in the southern Northwest Territories. Northcor completed a large aeromagnetic survey along the southern border of the Northwest Territories.

Three exploratory wells were also drilled this year. Conoco et al East MacKay I-55 and Conoco et al North Little Bear L-21, located south of Norman Wells, were both abandoned without testing. After disappointing results, the Shell et al Arrowhead 2B-76 well was also abandoned without testing.

Arctic Islands

No geological, geophysical or drilling activity took place in the Arctic Islands in 1988.

East Coast Offshore

East Coast offshore 1988 highlights included the successful delineation drilling at Terra Nova and Whiterose in the Jeanne d'Arc Basin off Newfoundland, and Mobil's gas discovery south of Sable Island.

Newfoundland Offshore

Several companies were involved in geophysical exploration in the Newfoundland offshore this year. All activity was confined to the Jeanne d'Arc Basin except for an airborne geochemical survey conducted by Amoco over a wide area. Chevron and Petro-Canada conducted seismic surveys, and Texaco and Petro-Canada each carried out high-resolution well-site surveys.

The Newfoundland offshore was the most active drilling area on frontier lands, with four delineation wells and five exploratory wells. Husky drilled two delineation wells within the Whiterose significant discovery area. Hydrocarbons were discovered in the primary objective at Husky/Bow Valley et al Whiterose E-09 and, when tested, flowed oil and gas at high rates. The second well, Husky/Bow Valley et al Whiterose A-90 located about 4 km to the east, did not find the primary reservoir section and the operator abandoned the well without testing.

Petro-Canada continued its success in the Terra Nova area, drilling and testing two more delineation wells. The Petro-Canada et al Terra Nova C-09 well, in the central portion of the structure, encountered a good oil-bearing reservoir and flowed oil at rates up to 1155 m^3 per day. The Terra Nova E-79 well, on the east flank of the structure, also found a thick reservoir section that flowed oil at rates up to 1400 m^3 per day.

Exploratory drilling was not as successful as in previous years. Mobil et al Avondale A-46 was dry and abandoned. Petro-Canada et al South Brook N-30, located south of Terra Nova, and Chevron et al East Rankin H-21, located south of Hibernia, were also dry and abandoned, but shows of heavy oil were reported. Texaco and partners commenced a three-well drilling program under the terms of a farm-out agreement with Husky and associates. The first well, Texaco et al South Merasheen K-55, was dry and abandoned without testing. The second wildcat well, Texaco et al Amethyst F-20, was spudded in late December and was drilling at year-end.

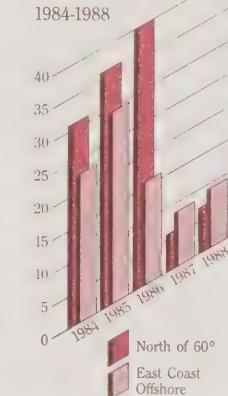
Nova Scotia Offshore

Geophysical activity was minimal during 1988; Mobil did a small side scan sonar study and Shell conducted one well-site survey.

In 1988 one exploratory well, Mobil et al South Sable B-44, was drilled south of Sable Island and tested gas at rates up to $594,881 \text{ m}^3$ per day. South Sable B-44 will be the twenty-second significant discovery in the Nova Scotia offshore.

Number of Wells Terminated

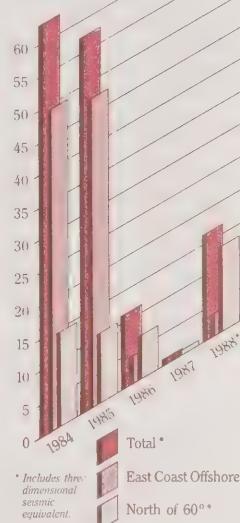
1984-1988



Reflection Seismic Shot on Frontier Lands

1984-1988

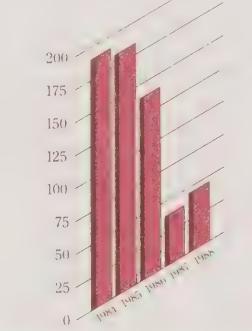
(thousands of km)



Exploratory and Delineation Drilling on Frontier Lands

1984-1988

(thousands of m)



Resource Evaluation Activities

Many of COGLA's resource management responsibilities rely on a sound understanding of the petroleum geology, geophysics and hydrocarbon potential of the frontier lands.

Analysis of Hydrocarbon Potential

COGLA conducts a variety of assessments to evaluate the hydrocarbon resources of Canada's frontier lands. These assessments range from regional projects over entire basins to smaller areas within regions, such as areas proposed for national park reserves.

In 1988 COGLA and the Institute of Sedimentary and Petroleum Geology of Calgary completed a hydrocarbon assessment of the Mackenzie Delta - Beaufort Sea basin. The assessment estimated potential oil and gas resources under the Beaufort Sea and the Mackenzie River basin at 1.13 billion m³ of oil and 1.9 trillion m³ of natural gas. These estimates are somewhat lower than those previously published.

During 1988 COGLA completed geological assessments of hydrocarbon prospectivity for a proposed national park on Banks Island and for proposed national marine parks in Lancaster Sound and the offshore area surrounding South Moresby Island in the West Coast offshore. COGLA also examined background information and compiled data on a proposed extension of the Nahanni National Park Reserve in the southern Northwest Territories. As well, COGLA assessed resources within the new Grasslands National Park in Saskatchewan.

For the several land use planning exercises, COGLA's geologists contributed important technical information and analysis of hydrocarbon prospectivity. In 1988 this work focused on the Lancaster Sound Regional Land Use Planning Commission, and preparatory work was initiated for the Beaufort Sea - Mackenzie Delta and Mackenzie Valley land use planning exercises.

Research

COGLA participated with the Canada Centre for Remote Sensing (RADARSAT Project) in a study to evaluate the merits of synthetic aperture radar (SAR) surveys for mapping subsurface geological structures and trends in the southern Northwest Territories. This work resulted in an experimental SAR survey over an area in the southern Northwest Territories near Fort Liard where subsurface structural trends are already well known.

COGLA collaborated with the National Research Council and Teknica Resource Development of Calgary on technical issues for the Tekxpert project designed to develop an interactive workstation for processing and interpreting seismic and well information using artificial intelligence. COGLA reviewed the project and recommended continued partial financial support under the Industrial Research Assistance Program.

COGLA initiated a joint industry-government committee to examine the influence of oil-based drilling muds on geochemical evaluation of well cuttings and cores. As a result, a research project was initiated with the objective to further define the problem and investigate solutions. This research program is now in progress under contract to Geofuels Inc. of Sydney, Nova Scotia, and is being funded under the Program for Energy Research and Development.

Conservation and Development

COGLA regulates the development and production of oil and gas on frontier lands and ensures effective conservation of these valuable, nonrenewable resources. Reservoir engineering studies provide the basis for effective regulation and control.

Mainland Territories

Norman Wells

COGLA continued to monitor the Norman Wells waterflood project. Positive trends established by the waterflood expansion continued — the oil rate and reservoir pressure increased and the gas-oil ratio decreased.

COGLA developed a production database for all Norman Wells production and injection wells with historical data starting in 1982. The database is updated monthly and cumulative production data is available for all wells.

Oil production from the Norman Wells field in 1988 totaled 1.728 million m³, an increase from 1.531 million m³ in 1987. The daily average oil production rate was 4721 m³ per day. Cumulative oil production to 31 December was 9.267 million m³.

Gas production in 1988 decreased to 138 million m³ from 163 million m³ in 1987.

There were 11 additional wells drilled in 1988, increasing the well count to 158 producers and 152 injectors.

Pointed Mountain

Gas production from the Pointed Mountain gas field continued to decline in 1988. Annual production decreased by 2 million m³ from 156 million in 1987 to 154 million. Cumulative gas production to year-end totaled 7.985 billion m³.

Beaufort Sea

Mackenzie Delta - Beaufort Sea Gas

This year Esso and Shell submitted applications for export licences to the National Energy Board to produce and export gas from discoveries in the Mackenzie Delta and Beaufort Sea region. The applications represent the first phase of a regulatory approval process that could lead to the development of an estimated 302.9 billion m³ of discovered gas reserves.

At year-end COGLA was reviewing gas reserve estimates and production capabilities for all Mackenzie Delta - Beaufort Sea gas discoveries. COGLA also finished a detailed geological and engineering study of the Taglu field, including full two-dimensional and three-dimensional computer simulation studies. Plans were under way to conduct similar studies on other significant fields such as Niglitingak, Parsons Lake, Amauligak and Issungnak.

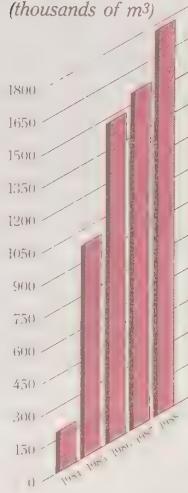
Amauligak

Gulf completed the delineation drilling program at the Amauligak F-24 berm site on the east side of the Amauligak structure. The F-24 and 2F-24B wells encountered significant oil and gas zones; they flowed at test-rates up to 1096 m³ of oil per day, and gas rates up to 670 000 m³ per day.

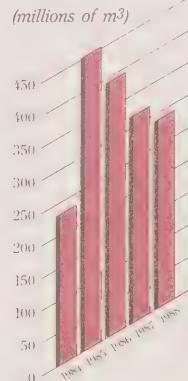
This drilling program completed the delineation phase for the Amauligak structure, resulting in six delineation wells following the 1984 Amauligak J-44 discovery. It is estimated that the field contains more than 79.5 million m³ of recoverable oil.

The operator and COGLA are now analyzing all data, including seismic data, well logs, cores, fluid analyses, drillstem test results and production test results. A comprehensive review of the geology and reservoir engineering aspects of the field will be prepared. The review will evaluate reserves, development systems, development-well drilling, production alternatives and production rates to maximize resource conservation.

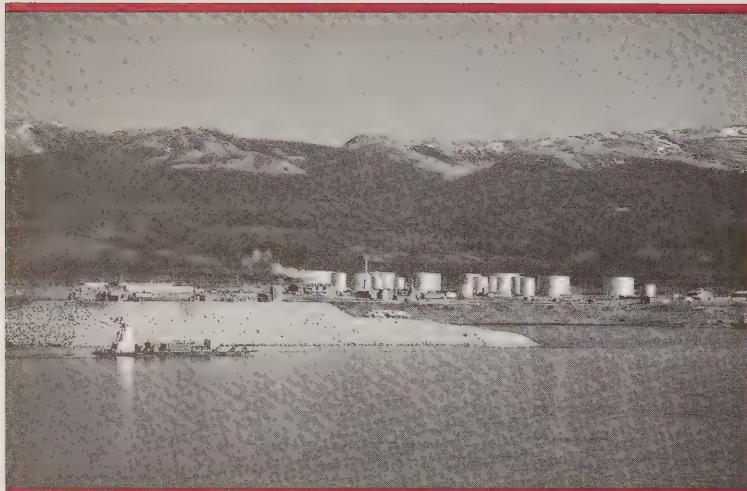
Oil Production on Frontier Lands 1984-1988 (thousands of m³)



Gas Production on Frontier Lands 1984-1988 (millions of m³)



Conservation and Development



Norman Wells production facility. Courtesy, B. Moore.



A gas producing well at Pointed Mountain in the southern Northwest Territories. Courtesy, W.F. Neeser.

Arctic Islands

Bent Horn

For the fourth year in a row, Panarctic undertook seasonal production at the Bent Horn oil field on Cameron Island and shipped oil to southern markets by tanker. The first shipment of 23 761 m³ left Bent Horn on 12 August on the *MV Arctic*. About 1700 m³ was dropped off at Resolute for the Northwest Territories Power Corporation. The *MV Arctic* picked up the second oil shipment (23 200 m³) on 4 September. After this shipment, more oil was produced and stored in the Bent Horn storage facilities to prepare for the next summer's shipping season. A total of 54 894 m³ of oil was produced from the Bent Horn field during 1988.

Newfoundland Offshore

Terra Nova Oil Field

The preliminary delineation program for the Terra Nova structure was completed in 1988 with the completion of the Terra Nova C-09 and Terra Nova E-79 wells. These highly successful wells extended the known limits of the excellent quality reservoir in the structure. Both wells flowed oil on test programs with rates as high as 1400 m³ per day.

This brings to seven the total number of delineation wells drilled following the 1984 Terra Nova K-08 discovery. The operator, Petro-Canada, announced it is undertaking an engineering feasibility study of alternative methods of development and expects to decide on a development plan application by September 1989.

Hibernia

Two reports on the Hibernia oil field were completed: Volume I presents the geology, reservoir data analysis and volumetric reserve calculations; and Volume II contains the results of the reservoir simulation study. COGLA presented the results of these studies to the Canada-Newfoundland Offshore Petroleum Board at its request. The studies provide estimates of oil recovery and production rates for the Hibernia field.

Protection of the Worker



During 1988 COGLA worked closely with the federal departments of Energy, Mines and Resources and Indian Affairs and Northern Development; the accord provinces; British Columbia; the Northwest Territories; Yukon; and the Canada-Newfoundland Offshore Petroleum Board (CNOPB) to finalize proposals for safety and technical amendments to the Oil and Gas Production and Conservation Act (OGPCA) and corresponding sections of the implementation legislation for the Atlantic and Canada - Nova Scotia accords. As part of this work, COGLA chaired two meetings with the Canadian Petroleum Association to discuss industry's views on the proposals. Toward the end of the year COGLA began work on the amendment drafting instructions for the Department of Justice.

Occupational Safety and Health

Under a memorandum of understanding (MOU) with Labour Canada, COGLA promotes the safety and health of workers involved in the exploration, production, processing, conservation or transportation of oil and gas in the frontier areas. This is stipulated in Part IV of the Canada Labour Code and the Oil and Gas Occupational Safety and Health Regulations. The code sets out workers' basic rights and promotes voluntary cooperation between employers and employees to solve safety and health concerns in the workplace. All workplaces must now have safety and health committees or representatives. The Minister of Labour appointed COGLA engineers and inspectors as safety officers to check the safety and health of personnel working at petroleum exploration and production sites.

In 1988 the Oil and Gas Occupational Safety and Health Regulations were amended to incorporate the Workplace Hazardous Materials Information System (WHMIS). WHMIS is a national system that provides information on hazardous materials used in the workplace. The system stresses the importance of carefully labeling containers of hazardous materials and providing material safety data sheets and educational programs for workers.



COGLA has also been involved in the drafting of occupational safety and health regulations for the Newfoundland offshore. COGLA and the Newfoundland Department of Energy drafted the Petroleum Occupational Safety and Health Regulations, Offshore Newfoundland, with help from CNOPB, the Nova Scotia Department of Mines and Energy, Labour Canada and the Newfoundland Department of Labour. To ensure consistent safety and health standards on all frontier lands, an MOU between relevant federal and provincial agencies was drawn up. The MOU would make CNOPB responsible for administering all occupational safety and health legislation for oil and gas workers in the Newfoundland offshore.

Drilling

Amendments to the Canada Oil and Gas Drilling Regulations came into effect in September. Some of the amendments respond to the requirements of the Statutory Instruments Committee and were developed through correspondence with the committee over several years. The rest were 'house-keeping' amendments covering updates of codes and standards referred to in the regulations, and minor changes for consistency with other regulations in force.

Survival suit being tested during development of survival suit standards.

Protection of the Worker



H₂S facility at the PITS Nisku Training Centre. Courtesy, Petroleum Industry Training Service.

In 1988 representatives of COGLA, the Newfoundland Department of Energy, the Nova Scotia Department of Mines and Energy, and CNOPB formed a committee to revise the Drilling Regulations. The revision will update the technical aspects to ensure that only the best and safest practices are used in the frontier areas. In addition, it will remove those occupational safety and health provisions that were included in the regulations under the Canada Labour Code. The committee expects to have a draft of these new drilling regulations available for industry review in early 1989.

Production

The petroleum industry and the classification societies reviewed a draft of the Production Installation Regulations that covers technical requirements for designing, constructing, installing, operating and maintaining a production installation. The regulations include requirements for a safety analysis to ensure the continuing safety of workers and the protection of the environment throughout the life of a production installation.

COGLA drafted development plan guidelines to help operators comply with OGPAC when seeking the minister's approval for development projects. The guidelines describe the information needed for a development plan application. They also discuss the requirements for a project's environmental and socioeconomic impact statement, environmental protection plan, contingency plans, waste treatment, effects monitoring and mitigative strategies.

COGLA drafted regulations for the design, construction and operation of offshore pipelines. The regulations will help to protect pipeline workers and the environment. The draft is now being discussed with provincial, territorial and federal government departments and regional boards concerned with regulating offshore pipelines. COGLA will consult industry on the draft in 1989.

Geophysical

The petroleum industry, provincial, territorial and federal government departments, and CNOPB reviewed drafts of the Canada Oil and Gas Geophysical Regulations and the Newfoundland Offshore Area Oil and Gas Geophysical Regulations. At year-end the regulations were being prepared for publication in the *Canada Gazette*.

Diving

The Canada Oil and Gas Diving Regulations and the Newfoundland Offshore Area Petroleum Diving Regulations came into effect in December. These regulations prescribe minimum training requirements and experience for divers and dive-related personnel. In addition, they address the technical and safety aspects of diving equipment, as well as the various types of diving operations.

Marine

In 1988 COGLA and the Canadian Coast Guard (CCG) formed regional technical committees to deal with issues concerning standby vessels used to support drilling units. The committees will look into any variations from the standards requested by operators with a view to the granting of equivalencies.

Also in 1988 the national COGLA/CCG Technical Committee made several changes to the Standards Respecting Standby Vessels. These changes resulted from recommendations by owners, operators and marine surveyors. The most significant change was to allow the carriage on deck of a limited amount and type of cargo while the vessel was on standby duty.

Safety Advisory Committee

COGLA, along with the Canadian Petroleum Association, chairs the Frontier Lands Safety Advisory Committee. This committee reviews all new regulatory initiatives with a view to promoting the safety of industry workers. It draws its membership from offshore boards, Department of Health and Welfare, CCG and industry associations to ensure that the best technical and managerial advice is applied to matters of safety.

Standards for Survival Suit Systems

COGLA chairs the committee responsible for developing survival suit standards. In 1988 the Survival Suits Committee drafted the marine abandonment survival suit standard and the working suit standard. These standards set out design and performance criteria for survival suit and working suit systems. The Canadian General Standards Board is expected to publish both standards in 1989. Once they are published, operators will have a reasonable amount of time to comply with the standards.

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1988

	Person-Hours at Work Site		Lost-Time Accidents		Accident Rate	
	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel
Mainland Territories	81 464	N/A	2	N/A	(LTA/Millions of Person-Hours)	
Mackenzie Delta and Beaufort Sea	957 290	344 592	9	1	24.5	N/A
Arctic Islands and Eastern Arctic Offshore	N/A	N/A	N/A	N/A	N/A	N/A
Grand Banks and Labrador Sea	482 402	197 184	11	7	22.8	35.5
Nova Scotia Offshore*	65 428	42 744	2	1	30.6	23.4
Total	1 586 584	584 520	24	9		

* Estimated.

Canadian Standards Association – Offshore Code

COGLA serves on the Canadian Standards Association (CSA) Steering Committee on Offshore Structures and its five technical committees, which were set up in 1984 to develop a code for the design, construction and installation of fixed offshore structures. Preliminary standards for design criteria and loads, foundations, steel structures, concrete structures and sea operations were published in 1988. COGLA and CSA have set up a program to verify the code's technical and practical aspects. This program will involve reviewing and commenting on the preliminary standards and carefully checking the standards' technical requirements.

Safety Training

In 1988 COGLA served on a technical committee that developed a training program to protect workers from deadly hydrogen sulphide (H_2S) gas, which is commonly associated with oil and gas in the subsurface. The committee included representatives from industry and the western provinces. The program consists of three progressively more detailed courses: H_2S Alive, H_2S Rescue and H_2S Instructor. Oil field staff working in H_2S areas are now required to take the course that corresponds to their duties.

COGLA worked with CCG to draft certification and manning regulations for the training and qualifications of technical and supervisory staff employed on mobile offshore drilling units or production vessels. When they come into force in 1989, these regulations will require all senior staff to have the appropriate oil field and marine qualifications for their position.

Inspections

As part of its mandate, COGLA carries out periodic inspections at exploration or production sites to assess the safety and effectiveness of the operation and to ensure compliance with regulations. In 1988 COGLA officers conducted 26 drilling and 6 production facilities inspections on the frontier lands.

Lost-Time Accidents

The accident rate for drilling operations, calculated as the number of lost-time accidents (LTAs) per million person-hours worked, increased in 1988 to 15.1 (compared with 9.7 in 1987). There were no production-related LTAs reported on the frontier lands in 1988. However, 11 lost-time accidents occurred while conducting geophysical operations. There were no fatalities associated with oil and gas exploration or production in 1988.

Physical Environmental Monitoring

As in the past three years, ice conditions over the Beaufort were very favorable for drilling. Pack ice moved from the Amauligak drilling area earlier than usual, permitting the *Kulluk* to begin operating two weeks ahead of schedule. Ice conditions remained very good throughout the summer drilling season with no hazardous ice reported within 40 nautical miles (76 km) of the drilling area.

Protection of the Worker



Ice rubble field formation as a result of ice and structure interaction. Courtesy, Gulf Canada Resources Ltd.

The *Bow Drill 3* and the *Sedco 710* operated on the Grand Banks during the 1987-88 pack ice season. Because of encroaching ice, the *Bow Drill 3* moved to Marysville from 29 February to 18 April. The *Sedco 710* also moved there from 31 March to 12 April. Although several icebergs moved over the northern Grand Banks, there were fewer than usual. Those that threatened drilling operations were successfully towed from the drilling units.

Research and Development

The Panel for Energy Research and Development (PERD) promotes the development of technical knowledge to help the federal government fulfil its responsibilities for supplying and managing crude oil, natural gas and electrical resources. Under PERD, COGLA chairs the Marine Engineering Committee and promotes studies on the construction of offshore structures, the interaction between ice and offshore structures, diving and evacuation technology, and environmental design criteria. Several research projects to resolve design and construction problems associated with frontier oil and gas activities in Canada were initiated during the year. The major projects managed by COGLA are described below.

Protection of Submarine Pipelines from Ice Scour

The goal of this project is to determine the extent to which ice scouring can threaten the integrity of offshore pipelines in the Beaufort Sea. In 1988 this project examined the effects of ice scour on the soils surrounding a buried submarine pipeline. The consultants compiled ice scour data representing typical conditions in the Beaufort Sea. The results will be entered into a computer program to determine the soil movement and other effects of ice scour on submarine pipelines.

Fill Retention Structures

COGLA worked with the petroleum industry to develop reliable methods for analyzing soil retention structures, such as caisson-retained drilling platforms, that are subject to cyclic loading pressures caused by ice movement. COGLA and the University of Ottawa organized a workshop of international experts and designers to examine various soil models used to describe the constitutive behavior of soils under cyclic loading.

These models were used in a study with the Atlantic Geoscience Centre and the United States National Science Foundation. The study concerned a caisson structure used in the Beaufort Sea. The results showed that the design method used for earthquake loading on land structures was not appropriate for ice loads in the Canadian offshore.

Ice-Structure Interaction

Among the several projects coordinated by a committee co-chaired by COGLA and Public Works Canada is one sponsored by COGLA that involves collecting data on the interaction between ice and fixed artificial structures. In 1988 this project examined the global and local ice loads experienced by the *Molikpaq* structure.

Evacuation Technology

In May 1988 COGLA conducted a safety technology workshop in St. John's, Newfoundland to establish research and development priorities for emergency equipment and sea-rescue techniques. Because helicopters are the preferred method for evacuating mobile offshore drilling units and are used in routine crew changes, the workshop concentrated on research priorities for all safety aspects of offshore helicopter operations.

In cooperation with industry, COGLA plays a leading role in the promotion of helicopter safety in the offshore. It is funding a study on how to exit safely from a helicopter downed in the water. At the same time, the Canadian Petroleum Association has commissioned a review of all documented relevant incidents of downed helicopters. Under a PERD contract, studies into emergency equipment suitable for attachment to helicopters are now under way. Following these studies, a critical assessment of equipment for helidecks on mobile offshore drilling units will take place.

Lifeboat Occupant Recovery System

The field trials for the Lifeboat Occupant Recovery System (LORS) finished in late 1987. A report on the program was prepared in 1988 and will be published in 1989 as part of the PERD technical series. COGLA funded the project through PERD in cooperation with Husky/Bow Valley, the U.K. Department of Energy, and the Newfoundland and Nova Scotia governments. The maximum environmental conditions encountered during the sea trials were 6.7 m seas with 28 knot winds. The LORS prototype hardware allows the lifeboat to be secured alongside the standby vessel in calm-to-moderate seas, while personnel transfer to the standby vessel.

Environmental Design Criteria

In anticipation of development projects in the southern Beaufort Sea, COGLA arranged with the Atmospheric Environment Service of the Department of the Environment to undertake storm-wind hindcasts. COGLA also made arrangements with the Department of Fisheries and Oceans to undertake wave and sea-current hindcasts. These studies produced a major comprehensive environmental database for the area and will help establish environmental design criteria for future use.

Another study will develop a computer program to evaluate design and operating strategies for floating oil-and-gas production structures subject to ice hazards and rough seas. Det Norske Veritas of Calgary is conducting the study with funds from Mobil, Elf Aquitaine, British Petroleum and COGLA.

Wave Effects on the Seabed

This research project brings geotechnical and coastal hydraulic engineering together to analyze wave-seabed interaction. Predicted seabed and sub-sea berm responses to wave action were compared with the behavior observed in the laboratory, especially for soil liquefaction. Future work will evaluate the relationship between sediment transport and geotechnical seabed failures caused by



liquefaction and slope stability. The project will improve the ability of physical and numerical modeling techniques to predict bottom erosion and settlement of caisson-type structures.

The LORS system allows the lifeboat to be attached to the standby vessel while transferring personnel. Courtesy, Husky Oil, East Coast Project.

Seismic Hazard Maps For Canadian Frontier Regions

The safe design and operation of offshore structures must consider the risk of earthquake activity. COGLA, with funding from PERD, helped develop and produce seismic hazard maps for eastern Canadian offshore regions, and for northern (i.e., Beaufort Sea and Arctic) and western Canadian offshore regions. The maps will become part of the database used to develop a part of the new Canadian Standards Association code for the design, construction and installation of fixed offshore structures.

Geotechnics Study

COGLA and the Atlantic Geoscience Centre monitored the revisions to a Beaufort Sea geotechnics study funded under PERD. This study contributed to the regional understanding of the structure and stratigraphy of the shallow geological section and, in particular, the characteristics and thickness of the permafrost. COGLA and the industry had recommended the revisions to the project the year before.

Protection of the Environment



Caribou in the northern Yukon.
Courtesy, Environment Canada,
Canadian Parks Service.

East Coast

Georges Bank

On 18 April 1988 the Minister of Energy, Mines and Resources called for an environmental moratorium on drilling on Georges Bank until the year 2000. The governments of Canada and Nova Scotia agreed to incorporate the moratorium in law through amendments to their implementing legislation for the Canada - Nova Scotia accord. The amended acts will also provide for an independent public review before mid-1999 on the potential environmental and socioeconomic impacts of exploration activities on the bank.

COGLA, the Department of External Affairs and the U.S. departments of Energy and of the Interior have arranged an informal liaison to encourage the transfer of scientific and environmental impact information between the parties on issues related to Georges Bank.

Texaco continued to assess the results of the field and laboratory studies that it undertook as part of a program to evaluate whether oil and gas activities would significantly affect the Georges Bank fisheries. Studies conducted in 1987 focused on the effects of oil spills, drilling muds and cuttings, particularly on scallops and lobsters.

West Coast

Environmental Review

In January the Pacific Environmental Coordinating Committee (PECC) held its inaugural meeting. At that time, PECC confirmed its membership and approved its terms of reference. Part of its mandate is to oversee the implementation of the West Coast Offshore Exploration Environmental Assessment Panel's recommendations as reflected in the joint government response to these recommendations which was released in June 1987. PECC established a federal-provincial Technical Working Group to identify ways to implement the accepted recommendations and to identify study needs and research priorities for the West Coast offshore.

In July the Technical Working Group held a workshop to develop a plan for environmental management of offshore hydrocarbon exploration in B.C. The draft workshop action plan report was completed in November and will be tabled with PECC in January 1989 for review.

In October COGLA and the B.C. Ministry of Energy, Mines and Petroleum Resources released a detailed status report on federal-provincial activities planned or under way that respond to the *West Coast Offshore Exploration Environmental Assessment Panel Report* released in April 1986. The document reviews the status of research and development, oil-spill contingency planning, oceanographic studies, weather forecasting and impact assessment.

COGLA and the B.C. Ministry of Energy, Mines and Petroleum Resources (MEMPR) drafted terms of reference and set up an ad hoc federal-provincial advisory committee on the socioeconomic aspects of planning for offshore petroleum exploration on the West Coast. COGLA joined MEMPR in producing the fourth edition of the *West Coast Offshore Update*, a newsletter produced to inform those interested in offshore exploration activity on the West Coast. This edition, which received wide distribution throughout B.C., focused on initiatives taken by both governments to address the panel's recommendations and highlighted research activities under way.



North

Amauligak

Gulf conducted a winter oil-spill exercise with several government organizations in accordance with an ocean dumping permit issued by Environment Canada. Gulf used Amauligak F-24 crude oil on landfast ice in the Beaufort Sea. Since previous exercises usually focused on summer operations, a winter exercise was needed to examine the capabilities necessary to meet the harsh challenges of winter drilling operations. The exercise tested different burning techniques to minimize cleanup in an actual spill.

This exercise was followed by a test of the emergency notification procedures, which is part of the Amauligak contingency plan. Although the results were satisfactory, the exercise identified several areas where improvement was needed.

Land-Use Planning

COGLA continued to work closely with the Beaufort Sea - Mackenzie Delta and Lancaster Sound Regional Land Use Planning commissions. It continued to chair the government-industry Oil and Gas Working Group for Lancaster Sound Regional Land Use Planning Initiatives and provided the commissions with technical information on hydrocarbon potential, petroleum geology and exploration methods. COGLA personnel also participated in workshops held in Resolute, Iqaluit and Inuvik.

Consultations

Guidelines

COGLA, in consultation with other government departments, the oil and gas boards and the industry, finished drawing up guidelines for the treatment and disposal of waste from offshore hydrocarbon exploration and production.

COGLA evaluated and updated guidelines for:

- environmental procedures for impact assessment;
- meteorological, oceanographic and ice programs;
- contingency planning;
- explosives; and
- oil-based drilling muds.

The Drilling Fluids Lubricant Task Force completed its report on the environmental effects of using diesel oil as a drilling fluid lubricant. Consultation continued in 1988 with the oil industry to develop guidelines for oil-spill monitoring.



Environmental Assessment

COGLA remained an active member of the Interdepartmental Committee on Environmental Assessment and advised the Federal Environmental Assessment Review Office on reforming environmental assessment. COGLA also continued to evaluate environmental impact assessment methods and helped develop a public participation manual for environmental assessment and project evaluation.

COGLA reviewed environmental impact statements for proposed lease sales by the U.S. Minerals Management Service; COGLA reviews such lease sales when they could affect Canada.

International Drilling Conference on Wastes

COGLA played a key role in sponsoring and organizing the 1988 International Conference on Drilling Wastes held in Calgary in April. The conference provided new and practical insights into the effects of disposing and treating drilling waste discharges on land and at sea. Proceedings from the conference will be published in 1989.

Environmental Action Plan

As a member of the Intradepartmental Working Group on Environmental Issues, COGLA helped develop EMR's departmental action plan on the environment, particularly for issues associated with offshore oil and gas activities.

An oil-spill absorbent boom used to absorb Amauligak crude oil during an experimental winter oil-spill exercise in the Beaufort Sea. Courtesy, G. McCormick.

Protection of the Environment



Close-up of a Beaufort artificial island showing erosion by wave action. Courtesy, Environmental Studies Research Funds.

Environmental Studies Research Funds

The Environmental Studies Research Funds (ESRF) finance environmental and social studies for regulatory decision-making on oil and gas exploration and development on frontier lands. COGLA administers the program, which is funded through a levy on oil and gas companies holding interests on frontier lands. The ESRF Management Board was established in 1988 and met twice. It drew up a budget and began an evaluation study to assess program effectiveness to date as a means of planning future directions of the program. ESRF studies completed in 1988 included the following:

The Dynamics of Iceberg Grounding and Scouring (DIGS)

The study examined the dynamics and effects of four selected iceberg groundings on the Makkovik Bank in the Labrador Sea. Scientists had suspected that the rolling of an unstable iceberg altered the seabed, but this field program provided the first documented proof. The DIGS experiment suggested that splitting and subsequent rolling of icebergs likely occurs often and could be a primary cause of seabed pits. The data clearly indicated that during the scouring process not only is seabed sediment modified by iceberg keels, but also that the keel ice itself is modified. DIGS was a large-scale, multidisciplinary project, funded by ESRF and other government departments. Government, universities and the private sector participated in the project.

Beaufort Sea Artificial Island Erosion Data

This report presents the results of a field survey that measured rates of erosion of an artificial sand island in the Beaufort Sea. The data will be used to calibrate numerical models of erosion processes; the models will assist in the design of islands in the Beaufort Sea. Calibrating models with field data will result in more precise engineering specifications and a better understanding of erosion patterns and processes over time.

Guide to Dispersant-Use Decision-Making for Oil Spills in the Canadian Beaufort Sea

This document is a step-by-step guide to help the on-scene commander and dispersant decision team decide whether to use chemical dispersants on oil spills in the southern Beaufort Sea. The guide includes:

- a statement of the regulatory framework for dispersant use in the Beaufort Sea;
- practical background information on oil spills and on dispersant decision-making in the Beaufort Sea;
- a detailed guide for making dispersant decisions for Beaufort Sea spills in a crisis; and
- an appendix documenting the resource data on which the environmental sensitivity assessments in the guide are based.

Employment and Industrial Benefits



Northern Developments

The small upswing in northern activities in 1987 continued into 1988. Overall employment data reflect this increase, particularly the number of jobs held by Northerners. An important part of this activity was the expanded Beaufort Sea operations: Gulf reactivated its second offshore drilling rig, Esso conducted an intensive three-dimensional seismic program, and Amoco and other operators conducted offshore geological and geophysical work.

Farther north, Panarctic again activated its seasonal Bent Horn operation, shipping two tanker loads of crude petroleum. Part of Panarctic's production, some 1700 m³ (3 per cent of total shipments) was sold to the Northwest Territories Power Corporation power-generation facility at Resolute, replacing costly diesel oil from southern Canada.

Increased exploration in the Mackenzie Valley, particularly seismic activity, provided more opportunities for Northerners in 1988. For example, the Chevron - Fort Good Hope joint venture created many jobs for residents in the community and surrounding areas. These activities helped compensate for the slowdown brought about when Esso completed its infill drilling program at Norman Wells.

As a result of both on-land and offshore activities, 1575 jobs were created. Northerners filled 23 per cent of these jobs. Only 25 foreign workers were employed in the North in 1988.

East Coast Developments

The signing of the statement of principles governing the Hibernia field development led to several significant contracts, such as the site surveys for the onshore construction site near Come-by-Chance and the offshore production site. In addition, three of the largest service contracts went out to bid:

- the project services contract, which included engineering design and procurement of the drilling and production facilities (i.e., topside facilities);
- the engineering design, procurement and construction contract for the gravity-base structure on which the topside facilities for Hibernia will sit; and
- the drilling facilities contract, which calls for the design, construction and operation of the two gravity-base structure mounted drill rigs, and their support equipment and modules.



Mobil began to conduct supplier seminars in major centres across Canada; the first one took place in St. John's, Newfoundland in December 1988. The seminars are designed to inform Canadian entrepreneurs about the timing of Hibernia contracts and the technical requirements bidders must meet to compete for the contracts.

Drilling and related activities continued steadily on the Grand Banks with employment ranging from 300 to 706 workers. Employment peaked during the first part of the year when two rigs were active. Of these workers, 98 per cent were Canadian.

One well off Nova Scotia was drilled between 27 March and 8 July. Employment peaked at 214 in May and June. Canadians made up 98 per cent of this workforce.

*Equipment being unloaded and personnel disembarking near Tuktoyaktuk, N.W.T.
Courtesy, G. McCormick.*

Employment and Industrial Benefits

Canadian Market Opportunities Program

During 1988 COGLA was invited to become a non-voting member of the board of the Canadian Market Opportunities Program (CMOP) along with Industry, Science and Technology Canada, the federal government's voting member. CMOP is a private sector program that represents the petroleum industry and its suppliers, buyers, contractors, consultants and associations. The program aims to increase the level of participation of Canadian suppliers in petroleum activities and encourages the development of domestic sources for goods and services not yet supplied by Canadians. Regional chapters from the Maritimes and Central, Western and Northern Canada meet regularly to promote CMOP goals.

Employment Equity

When the federal Employment Equity (EE) Act and its associated regulations came into force, it became evident in late 1987 and during 1988 that there were areas where the EE Act and COGLA's legislation overlapped. To reduce the reporting burden on the oil and gas industry, industry and government agreed that the EE Act would prevail for all employment equity reporting required for activities regulated by COGLA.

TOTAL 1988 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total Work Force*	Canadian	Per Cent Canadian
Mainland Territories	863	863	100
Mackenzie Delta and Beaufort Sea	685	660	96
Arctic Islands and Eastern Arctic Offshore	27	27	100
Grand Banks and Labrador Sea	706	692	98
Nova Scotia Offshore	214	210	98
Total	2 495	2 452	98.3

* Represents approximate number of jobs created.

TOTAL 1988 PETROLEUM EXPENDITURES ON FRONTIER LANDS

	Exploration*	Development	Production (millions of \$)	Total	Canadian	Per Cent Canadian**
Mainland Territories	15.0	5.3	5.3	25.6	24.1	94.1
Mackenzie Delta and Beaufort Sea	126.6	—	—	126.6	101.3	80.0
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—
Grand Banks and Labrador Sea	159.8	—	—	159.8	94.3	59.0
Nova Scotia Offshore	31.7	—	—	31.7	18.1	57.1
Total	333.1	5.3	5.3	343.7	237.8	69.1

* Includes geophysical expenditures.

** Historical estimates.

Data Management

Regional Statistical Summary

COGLA collects, stores and distributes information arising from geological and geophysical activities, wells drilled and the administration of exploration and development rights. COGLA personnel use the data for evaluation purposes, and make it available to industry and the public after the data are released from confidential status.

Three primary databases now provide an integrated framework for data management in COGLA.

Over the past several years, COGLA has developed and implemented digital database systems to support data management activities. The first one completed was the Land Information System. It contains data on all agreements and licences administered by COGLA. The loading of the database was completed early in 1988.

COGLA and the Canada-Newfoundland Offshore Petroleum Board jointly developed a computer-based shotpoint location system. The system is used to manage operational, statistical and geographical information for all geological and geophysical programs carried out on the frontier lands. The system was implemented in late 1987. About 800 000 line kilometres of historical location data were loaded into the database during 1988.

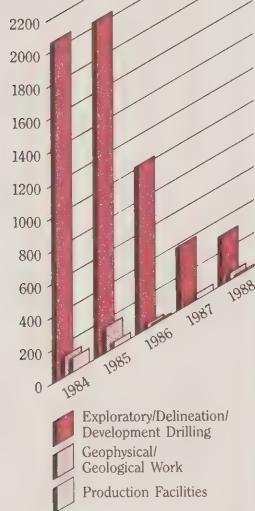
A system for storing and retrieving drilling and geological data for all wells drilled or being drilled was also implemented in late 1987. Base data for almost 2000 wells were included by year-end, and research and verification of information continued in 1988.

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Frontier Lands

Statistical Summary

Petroleum
Expenditures
on Frontier Lands
1984-1988
(millions of \$)



ACTIVITY STATUS ON FRONTIER LANDS	1984	1985	1986	1987	1988
Licences/Agreements (ELs/EAs/SDLs) Concluded	47	5	23	42	105
Wells Spudded	120	99	60	48	25
Metres Drilled	241 298	207 896	150 404	67 234	54 391
Wells Terminated	123	103	70	50	27
Significant Discoveries	11	25	14	1	2
Geophysical Programs Run	65	55	15	7	27
Reflection Seismic km	63 817	57 091	11 001	2 756	16 568
Rig-Months	236	199	133	41	37

FRONTIER LANDS RESOURCE INVENTORY	OIL*		GAS	
	Discovered (millions of m³)	Potential	Discovered (billions of m³)	Potential
West Coast	0	50	0	270
Mainland Territories	37.2	95	20.8	312
Mackenzie Delta and Beaufort Sea	253.2	1 112	308.5	1 918
Arctic Islands and Eastern Arctic Offshore	65.7	873	416.4	3 156
Hudson Bay	0	127	0	88
Grand Banks and Labrador Sea	212.0	1 192	146.8	1 286
Nova Scotia Offshore	22.9	318	162.4	663
Total	591.0	3 767	1 054.9	7 693

* Includes condensate.

OIL AND GAS PRODUCTION ON FRONTIER LANDS	1984	1985	1986	1987	1988
Oil Production (thousands of m³)					
Norman Wells	175	949	1 411	1 531	1 728
Bent Horn	—	29.5	17.5	34.5	54.9
Amauligak	—	—	50	—	—
Panuke	—	—	—	3.7	—
Gas Production (millions of m³)					
Pointed Mountain	194	226	205	156	154
Norman Wells	41	227	188	163	138

Mainland Territories

Statistical Summary



ACTIVITY STATUS	1984	1985	1986	1987	1988
Wells Spudded					
Exploratory/Delineation	18	15	14	1	3
Development	67	39	14	35	11
Total	85	54	28	36	14
Wells Terminated*					
Exploratory/Delineation	15	17	14	2	3
Development	69	38	14	36	11
Total	84	55	28	38	14
Metres Drilled					
Exploratory/Delineation	80 804	53 924	36 289	31 132	15 778
Development	28 769	23 968	24 401	974	7 095
	52 035	29 956	11 888	30 158	8 683
Geophysical Programs Run					
Reflection Seismic km	20	17	7	5	9
	5 371	5 819	2 095	149	1 729**

* In the Mainland Territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be reentered in the following year for testing.

** Includes three-dimensional seismic equivalent.



RESOURCES STATUS	1984	1985	1986	1987	1988
Discovered Resources*					
Gas (billions of m ³)	21.2	21.4	20.3	20.8	20.8
Oil (millions of m ³)	52.3	51.0	51.0	37.2	37.2
Gas and Oil Production					
Pointed Mountain Gas (millions of m ³)	194	226	205	156	154
Norman Wells Gas (millions of m ³)	41	227	188	163	138
Norman Wells Oil (thousands of m ³)	175	949	1 411	1 531	1 728

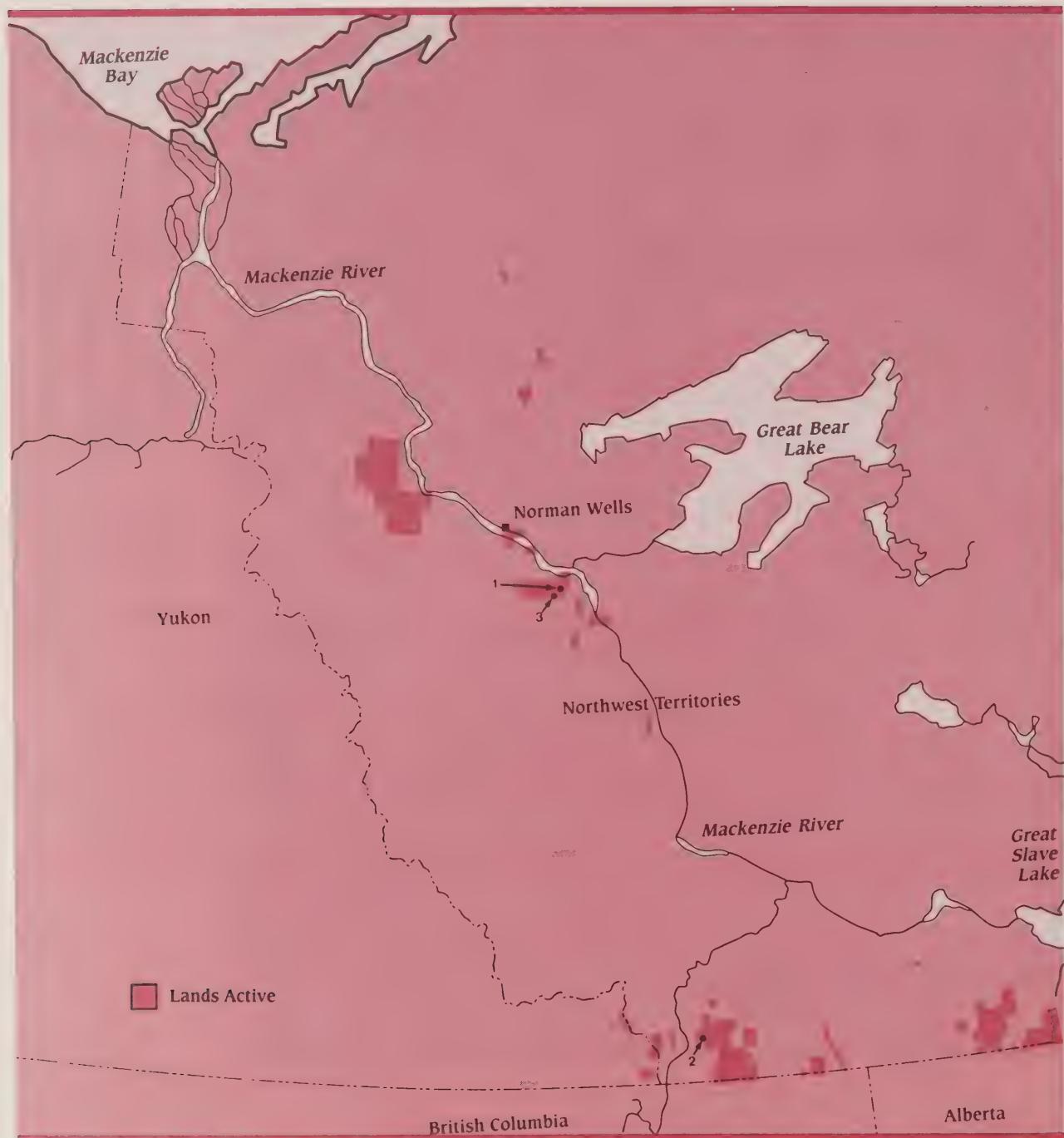
* As reported in previous years.

BENEFITS STATUS	1984	1985	1986	1987	1988
Rigs Active	14	11	11	3	3
Rig-Months	47	31	33	13	6
Money Spent (millions of \$)					
Geophysical/Geological	48.2	60.0	11.1	2.4	8.7
Exploratory/Delineation Drilling	49.5	69.3	54.1	4.4	6.3
Development Drilling	72.1	35.2	14.3	27.0	5.3
Production Facilities	86.1	23.5	5.6	30.5	5.3
Total Money Spent (millions of \$)	255.9	188.0	85.1	64.3	25.6

LAND STATUS	1984	1985	1986	1987	1988
Licences (ELs/SDLs) Concluded	7	0	0	24	18
Total ELs/SDLs Active	34	34	30	29	30
Lands Negotiated into ELs/SDLs (millions of ha)	1.4	0	0	4.5	0.08
Lands Relinquished/Surrendered (millions of ha)	0.1	3.1	3.3	4.7	0.9
Lands Active (millions of ha)	12.3	9.2	5.7	2.3	1.2

Mainland Territories

Statistical Summary





Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Conoco et al East MacKay I-55	64°44'43" N 125°39'44" W	Atco/Equitak 76	88-01-11 88-02-17	Plugged & abandoned	2 165
2.	Shell et al Arrowhead 2B-76	60°25'07" N 122°58'38" W	Hi-Tower 21	88-01-21 88-03-13	Plugged & abandoned	2 900
3.	Conoco et al North Little Bear L-21	64°40'40" N 125°50'25" W	Atco/Equitak 76	88-02-24 88-03-13	Plugged & abandoned	2 030

In 1988 abandonment operations were completed for the following wells:

Briggs Rabbit Lake No. 1
Briggs Rabbit Lake No. 3
CPOG et al Labiche F-08
Socony Mobil WM Birch YT B-34
Candel DEC KMC et al East MacKay B-45

Mackenzie Delta and Beaufort Sea

Statistical Summary



ACTIVITY STATUS	1984	1985	1986	1987	1988
Wells Spudded Exploratory/Delineation	6	19	17	3	3
Wells Terminated* Exploratory/Delineation	12	16	24	13	4
Metres Drilled Exploratory/Delineation	31 682	48 370	48 016	8 344	13 438
Geophysical Programs Run Reflection Seismic km	13 7 959	8 4 700	5 4 756	1 139	7 11 475**

* In the Beaufort Sea, where operations are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

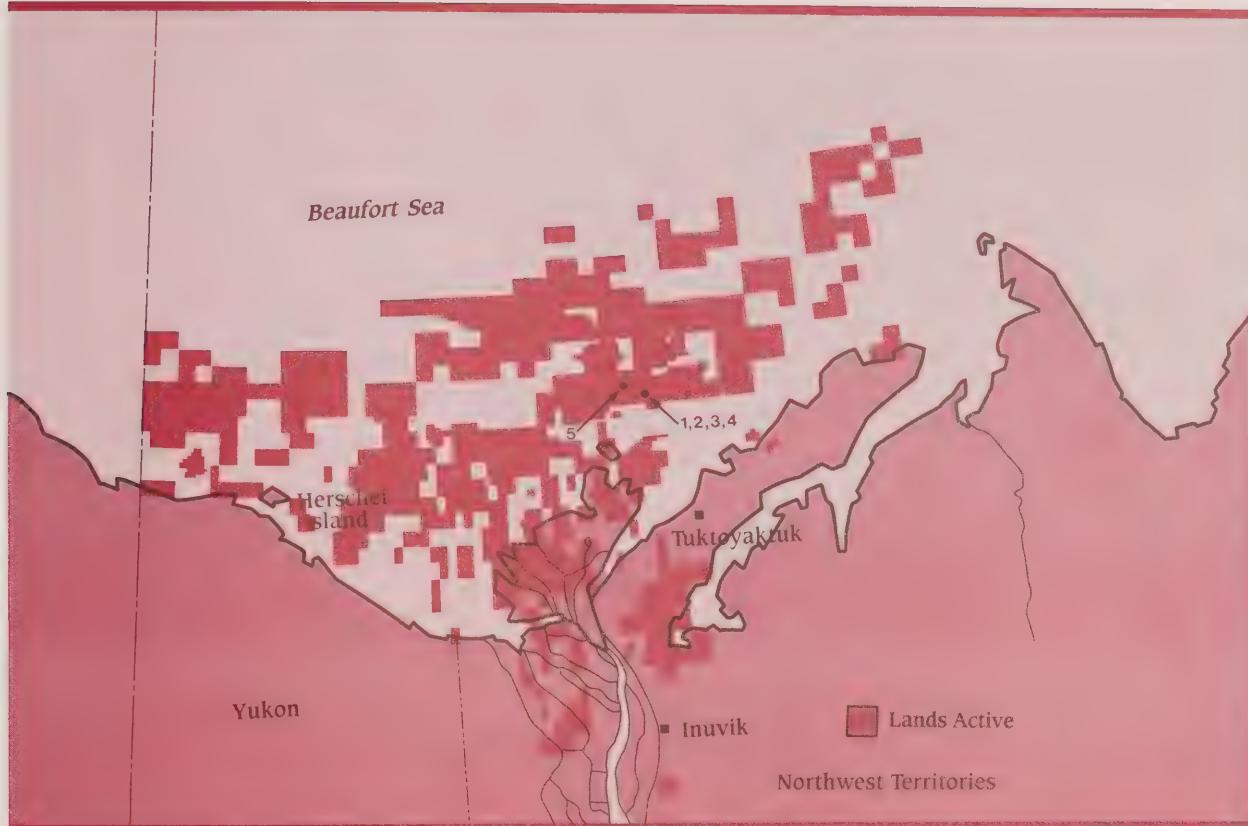
** Includes three-dimensional seismic equivalent.

RESOURCES STATUS	1984	1985	1986	1987	1988*
Discovered Resources**					
Gas (billions of m ³)	279.5	284.2	292.8	302.1	308.5
Oil (millions of m ³)	130.4	183.1	193.2	253.2	253.2
Oil Production Amauligak (thousands of m ³)			50.4		

* Includes new discoveries and revisions to previous estimates.

** As reported in previous years.

BENEFITS STATUS	1984	1985	1986	1987	1988
Rigs Active	11	13	11	3	2
Rig-Months	39	43	43	5	10
Money Spent (millions of \$)					
Geophysical/Geological Exploratory/Delineation Drilling	27.2 786.4	38.4 760.5	14.6 391.5	0.2 108.6	27.6 99
Total Money Spent (millions of \$)	813.6	798.9	406.1	108.8	126.6
LAND STATUS	1984	1985	1986	1987	1988
Licences (ELs/SDLs/PLs) Concluded	9	0	0	11	49
Total ELs/SDLs/PLs Active	24	23	23	28	59
Lands Negotiated into ELs/SDLs (millions of ha)	1.8	0	0	2.1	1.4
Lands Relinquished/Surrendered (millions of ha)	0.3	1.6	3.1	1.4	2.1
Lands Active (millions of ha)	8.9	7.3	4.2	2.9	3.4



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Gulf et al Amauligak F-24 (Amauligak delineation)	70°03'17" N 133°37'49" W	Molikpaq	87-10-01 87-12-18 88-02-18 88-04-13 88-08-10 88-08-12	Plugged & abandoned, oil & gas	5 260
2.	Gulf et al Amauligak 2F-24 (Amauligak delineation)	70°03'17" N 133°37'49" W	Molikpaq	87-12-22 88-01-29	Plugged & abandoned	4 260
3.	Gulf et al Amauligak 2F-24A (Amauligak delineation)	70°03'17" N 133°37'49" W	Molikpaq	88-01-30 88-02-17	Plugged & abandoned, gas	3 760
4.	Gulf et al Amauligak 2F-24B (Amauligak delineation)	70°03'17" N 133°37'49" W	Molikpaq	88-04-15 88-08-07	Plugged & abandoned, oil & gas	4 577
5.	Gulf et al Amauligak O-86	70°05'48" N 133°55'26" W	Kulluk	88-06-30 88-08-26	Plugged & abandoned, oil & gas discovery	3 910

In 1988 Gulf Canada Resources Ltd. drilled a corehole at the Amauligak site to determine the nature and characteristics of the subsea permafrost.

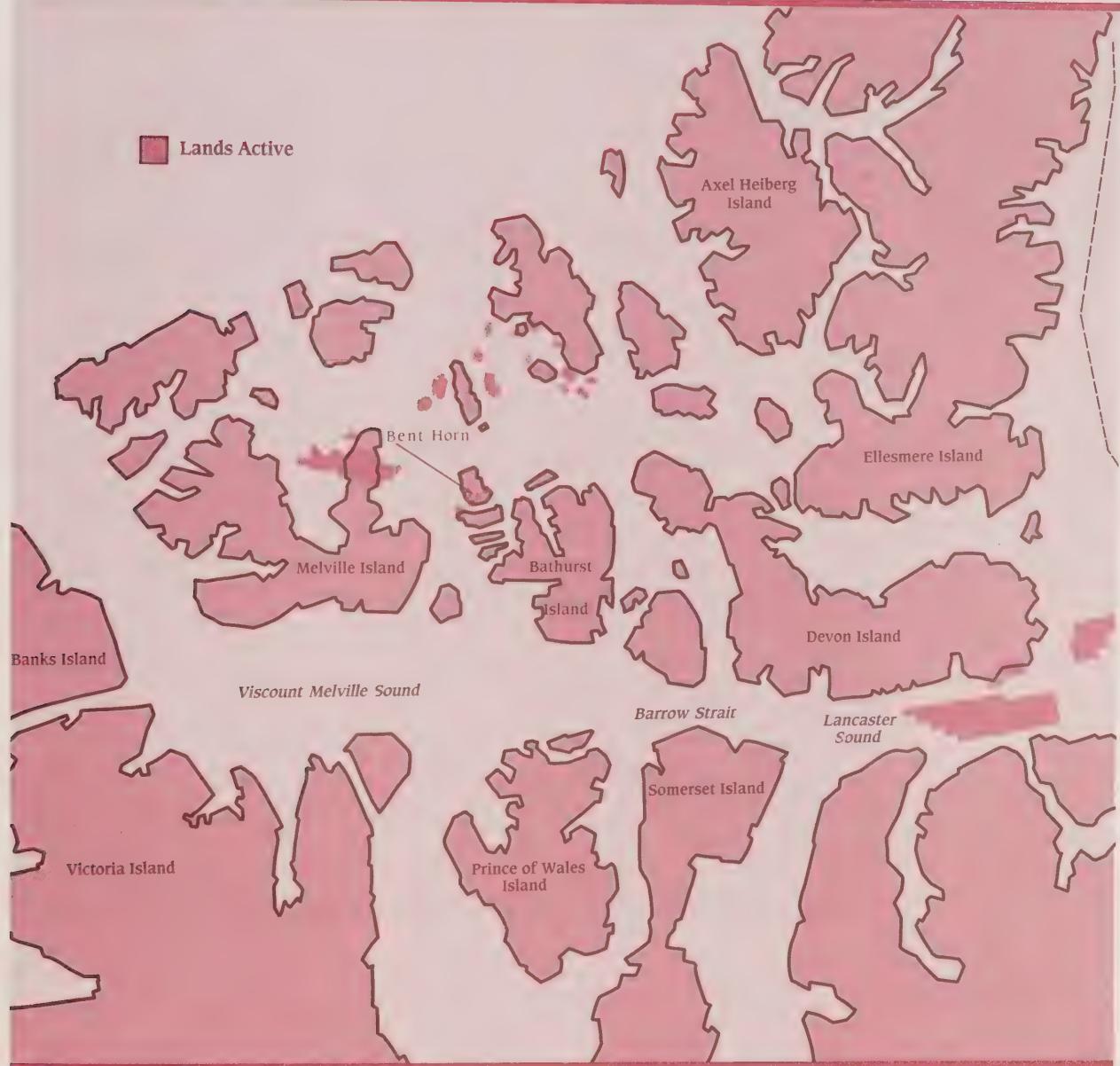
Arctic Islands and Eastern Arctic Offshore

Statistical Summary



ACTIVITY STATUS	1984	1985	1986	1987	1988
Wells Spudded Exploratory/Delineation	3	3	2	1	0
Wells Terminated Exploratory/Delineation	4	3	2	1	0
Metres Drilled Exploratory/Delineation	11 007	6 185	4 940	689	0
Geophysical Programs Run Reflection Seismic km	1	0	0	0	0
RESOURCES STATUS	1984	1985	1986	1987	1988
Discovered Resources*					
Gas (billions of m ³)	390.1	415.7	416.4	416.4	416.4
Oil (millions of m ³)	49.3	65.7	65.7	65.7	65.7
Oil Production Bent Horn (thousands of m ³)		29.5	17.5	34.5	54.9
BENEFITS STATUS	1984	1985	1986	1987	1988
Rigs Active	4	3	2	1	0
Rig-Months	13	9	4	2	0
Money Spent (millions of \$)					
Geophysical/Geological	4.6	0.2	0	0	0
Exploratory/Delineation Drilling	64.0	48.0	34.5	8.3	0
Production Facilities	0	7.8	0.6	0.5	0
Total Money Spent (millions of \$)	68.6	56.0	35.1	8.8	0
LAND STATUS	1984	1985	1986	1987	1988
Licences (ELs/SDLs/PLs) Concluded	3	1	1	3	24
Total ELs/SDLs/PLs Active	24	25	21	16	30
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	1.5	0.7	0.9	0.3	0.4
Lands Relinquished/Surrendered (millions of ha)	0.9	1.4	8.9	5.9	0.6
Lands Active (millions of ha)	15.8	15.1	7.5	1.6	1.4

* As reported in previous years.



In 1988 abandonment operations were completed for the BP et al Panarctic Hotspur J-20 well.

Nova Scotia Offshore (including the Gulf of St. Lawrence)

Statistical Summary



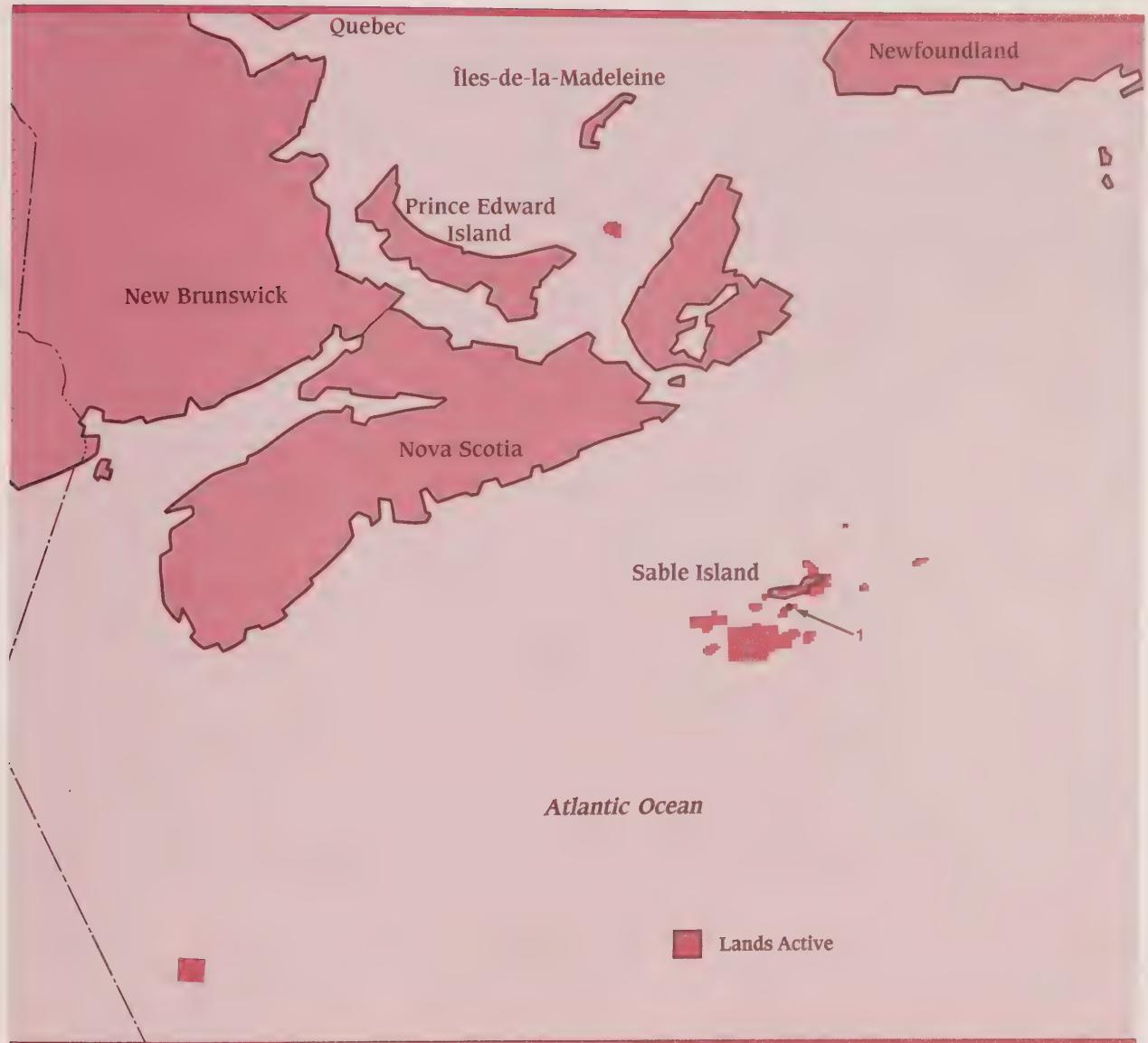
ACTIVITY STATUS	1984	1985	1986	1987	1988
Wells Spudded Exploratory/Delineation	14	10	6	3	1
Wells Terminated Exploratory/Delineation	13	14	8	3	1
Metres Drilled Exploratory/Delineation	71 046	47 064	29 744	9 583	5 208
Geophysical Programs Run Reflection Seismic km	17	14	2	1	2
	21 587	26 814	613	195	0
RESOURCES STATUS	1984	1985	1986	1987	1988*
Discovered Resources**					
Gas (billions of m³)	122.6	127.4	150.6	160.9	162.4
Condensate and Oil (millions of m³)	16.7	20.0	22.1	22.9	22.9
Oil Production (thousands of m³) Panuke				3.7	

* Includes new discoveries and revisions to previous estimates.

** As reported in previous years.

BENEFITS STATUS	1984	1985	1986	1987	1988
Rigs Active	10	8	5	2	1
Rig-Months	83	50	22	5	4
Money Spent (millions of \$)					
Geophysical/Geological Exploratory/Delineation Drilling	23.2	29.2	0.9	0.2	0.2
	594.7	452.0	176.8	35.3	31.5
Total Money Spent (millions of \$)	617.9	481.2	177.7	35.5	31.7
LAND STATUS	1984	1985	1986	1987	1988
Exploration Agreements (EAs) Concluded	15	2	13	3	1
Total EAs Active*	30	28	15	17	15
Lands Negotiated into EAs (millions of ha)	10.5	0.9	1.7	0.3	0.04
Lands Relinquished/Surrendered (millions of ha)	8.5	2.8	3.2	1.1	0.4
Lands Active* (millions of ha)	6.3	4.2	1.1	0.7	0.3

* Includes declared significant discovery areas.



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Mobil et al South Sable B-44	43°53'06" N 59°51'41" W	Rowan Gorilla I	88-03-27 88-07-08	Plugged & abandoned, gas discovery	5 208

In 1988 abandonment operations were completed for the following wells:

- Mobil Tetco Cohasset D-42
- Mobil Tetco Texaco Citnalta I-59
- Mobil Texaco Pex Olympia A-12
- Mobil et al Arcadia J-16

Appendix I

Newfoundland Offshore

(1986-1988 data verified by the Canada-Newfoundland Offshore Petroleum Board)
Statistical Summary



ACTIVITY STATUS	1984	1985	1986	1987	1988
Wells Spudded Exploratory/Delineation	12	11	7	5	7
Wells Terminated Exploratory/Delineation	10	13	8	5	8
Metres Drilled Exploratory/Delineation	46 759	49 098	31 415	17 486	19 967
Geophysical Programs Run Reflection Seismic km	12	16	1	0	9
	27 808	19 758	3 537	0	3 364
RESOURCES STATUS*	1984	1985	1986	1987	1988**
Discovered Resources***					
Gas (billions of m ³)	145.2	152.4	146.8	146.8	146.8
Oil (millions of m ³)	159.9	185.1	176.5	181.0	212.0
* These figures have been generated by COGLA and may differ from those published by CNOPB.					
** Includes new discoveries and revisions to previous estimates.					
*** As reported in previous years.					
BENEFITS STATUS	1984	1985	1986	1987	1988
Rigs Active	9	8	6	2	2
Rig-Months	54	63	31	16	17
Money Spent (millions of \$)					
Geophysical/Geological	27.8	27.3	4.1	0	5.2
Exploratory/Delineation Drilling	485.9	630.0	347.0	200	154.6
Total Money Spent (millions of \$)	513.7	657.3	351.1	200	159.8
LAND STATUS	1984	1985	1986	1987	1988
Exploration Licences (ELs/SDLs) Concluded	13	0	9	1	12
Total ELs/SDLs Active	41	38	27	21	19
Lands Negotiated into ELs/SDLs (millions of ha)	6.0	0	1.5	0.1	0.1
Lands Relinquished/Surrendered (millions of ha)	8.6	10.9	9.2	1.8	1.0
Lands Active (millions of ha)	22.0	11.9	3.4	1.7	0.8



Newfoundland Offshore

Statistical Summary

Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Husky/Bow Valley et al Whiterose E-09 (Whiterose delineation)	46°48'26" N 48°01'23" W	Bow Drill 3	87-08-20 87-11-11 88-01-12 88-02-22 88-04-20 88-07-01	Plugged & suspended, oil	3 970
2.	Petro-Canada et al Terra Nova C-09 (Terra Nova delineation)	46°28'10" N 48°30'58" W	Sedco 710	87-12-06 88-03-04 88-06-15 88-08-01	Plugged & suspended, oil	3 640
3.	Petro-Canada et al Terra Nova E-79 (Terra Nova delineation)	46°28'30" N 48°26'43" W	Sedco 710	88-03-05 88-06-14	Plugged & suspended, oil	3 605
4.	Husky/Bow Valley et al Whiterose A-90 (Whiterose delineation)	46°49'11" N 47°57'18" W	Bow Drill 3	88-07-02 88-08-11	Plugged & abandoned	3 025
5.	Mobil et al Avondale A-46	46°35'08" N 48°36'18" W	Sedco 710	88-08-01 88-08-21	Plugged & abandoned	2 025
6.	Petro-Canada et al South Brook N-30	46°19'52" N 48°34'06" W	Sedco 710	88-08-22 88-09-18	Plugged & abandoned	1 789
7.	Chevron et al East Rankin H-21	46°30'27" N 48°48'10" W	Sedco 710	88-09-19 88-10-27	Plugged & abandoned	2 150
8.	Texaco et al South Merasheen K-55	47°04'43" N 47°53'23" W	Bow Drill 3	88-10-25 88-12-22	Plugged & abandoned	3 545
9.	Texaco et al Amethyst F-20	46°39'23" N 48°02'28" W	Maersk Vinlander*	88-12-25	Drilling	621

* The Bow Drill 3 was renamed the Maersk Vinlander effective 8 December 1988.

Glossary of Terms



Abandoned Well: Any well that has been permanently plugged.

Benefits Plan: A plan submitted by operators and approved by the minister that states the employment and procurement intentions of operators related to their exploration and development activities on frontier lands.

Berm: A submerged artificial island constructed from dredged material and designed to form a base for bottom-founded mobile structures.

Completed Well: A well that has been drilled and equipped so that it is capable of producing oil or gas.

Cubic Metre of Gas: Equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.

Cubic Metre of Oil: Equivalent to 6.2898 American stock tank barrels.

Delineation Well: A well drilled as a follow-up to a discovery well on the same geological feature, with the purpose of determining the extent and commercial potential of the oil or gas accumulation encountered in the discovery well.

Development Plan: A development plan describes the approach and facilities that the proponent intends to use to recover hydrocarbon resources based on the proponent's interpretation of geology and reservoir characteristics of a field.

Drillstem Test: A test involving temporary completion of a well to evaluate fluid flow rates and to collect fluid samples.

Dry Hole: A well that has failed to find significant amounts of oil or gas.

Exploration Licence: A licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a Production Licence subject to compliance with the other provisions of the Canada Petroleum Resources Act (formerly called an Exploration Agreement under the Canada Oil and Gas Act).

Exploratory Well: A well drilled on a geological feature where no significant discovery has previously been made (synonymous with wildcat well).

Geotechnics: The field of science that deals with the physical and mechanical properties of soil and rock for engineering purposes.

Hectare (ha): 10 000 square metres (equivalent to 2.47 acres).

Hindcasting: The application of forecasting techniques or numerical prediction models to determine past meteorological or oceanographic conditions. Databases produced by hindcasting techniques supplement the duration and spatial coverage of historical measured data. Hindcasts are used for extreme value estimation of design parameters and for climate definition.

Hydrocarbon: A naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.

Infill Drilling: Drilling of wells between existing wells to better exploit the reservoir.

Injection Well (Injector): A well in which fluids are injected into an underground formation to increase reservoir pressure.

Landfast Ice: Sea ice that forms and remains attached to the shore.

Mobile Arctic Caisson: An annular steel caisson (better known as the *Molikpaq*), with deck dimensions of 75 m × 73 m, which is designed to be set down on a underwater berm.

Mobile Offshore Drilling Unit (MODU): Any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.

Primary Objective: The subsurface reservoir section thought to be the most likely to contain petroleum.

Reflection Seismic: The primary geophysical technique used in petroleum exploration for mapping subsurface geological features. Acoustic pulses created at the surface are reflected from layers that have different acoustic properties within the earth. The pulses are recorded at the surface for processing and interpretation.

Rights Issuance: The process of granting an exploration licence to a company for a parcel of Crown reserve lands.

Shotpoint: The geographic location on the surface of the earth representing the centre of origin for the energy source that is discharged during a reflection seismic survey.

Significant Discovery: A discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and suggests the existence of an accumulation that has potential for sustained production.

Stratigraphy: The study of stratified rocks, especially the correlation of layers in different localities.

Suspended Well: A well in which drilling or production operations have temporarily ceased.

Terminated Well: A well that has reached total depth and has been abandoned, completed or suspended.

Waterflood: A method of recovery in which water is injected into a reservoir to remove additional quantities of oil from the reservoir.

COGLA Offices

Region	Mailing Address	Street Address	Telephone	Telex	Telecopier
Headquarters	15th Floor, Tower B 355 River Road Vanier, Ontario K1A 0E4	14th Floor, Tower B 355 River Road Vanier, Ontario	(613) 993-3760	053-4366	993-9897
Maritimes	2000 Barrington Street Suite 102 Halifax, Nova Scotia B3J 3K1	Cogswell Tower, Scotia Square 2000 Barrington Street Suite 102 Halifax, Nova Scotia	(902) 426-8570	019-23632	426-5253
	COGLA Laboratory P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2	Bedford Institute of Oceanography, Dartmouth, Nova Scotia	(902) 426-3179 (902) 426-2525	—	—
Northwest Territories	P.O. Box 1500 Yellowknife, N.W.T. X1A 2R3	Bellanca Building 4914-50th Street 6th Floor Yellowknife, N.W.T.	(403) 920-8175	034-45570	873-8707
Western	P.O. Box 2638 Station M Calgary, Alberta T2P 3C1	3rd Floor Merland Building 630-4th Ave. SW Calgary, Alberta	(403) 292-5631	—	—





Canada



Energy, Mines and
Resources Canada
Indian and Northern
Affairs Canada

Energie, Mines et
Ressources Canada
Affaires indiennes
et du Nord Canada

CAI
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The Canada
Oil and Gas Lands
Administration

Annual Report
1989

Corporate Profile

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a memorandum of understanding between the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development.

COGLA is the federal government's principal contact with the oil and gas industry in matters relating to the regulation of oil and gas activity on Canada's frontier lands. These lands include Yukon Territory, the Northwest Territories, Hudson Bay and most of the country's offshore areas. The Canada-Newfoundland Offshore Petroleum Board has operational responsibility for the Newfoundland and Labrador offshore. A new Canada-Nova Scotia Offshore Petroleum Board with operational responsibility for the Nova Scotia offshore will be established when legislation implementing the Canada-Nova Scotia Accord is proclaimed in the new year.

COGLA's prime responsibility is to regulate the exploration for, and the development and production of, oil and gas on frontier lands in a manner that promotes safety of the worker, effective resource conservation, environmental protection, and full and fair access for Canadians to benefits and opportunities.

COGLA has five branches:

- Rights Management Branch
- Engineering Branch
- Resource Evaluation Branch
- Environmental Protection Branch
- Policy Analysis and Coordination Branch

COGLA's Yellowknife office has operational responsibility for the northern offshore and onshore areas. This office regulates the geological and engineering, and Canada Benefits aspects of oil and gas exploitation activities, by issuing authorizations to drill wells, by monitoring reports and other data submitted on operations, and by conducting regular on-site inspections.



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Messages from the Ministers



Jake Epp, Minister of Energy, Mines and Resources.

I am pleased to submit to Parliament the eighth annual report of the Canada Oil and Gas Lands Administration (COGLA). This agency is responsible for regulating oil and gas activities in areas of Canada's frontier lands not under joint management regimes. COGLA also provides advice and information to the federal government on petroleum industry activities.

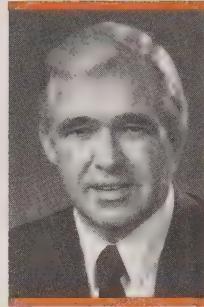
When this government came to power in September 1984, it moved swiftly to replace the National Energy Program and to introduce a sensitive, market-oriented approach to energy issues. Part of that process was the introduction of the Frontier Energy Policy of 1985: a policy designed to bring back a sense of unity, cooperation and fairness between governments and the industry in matters relating to frontier oil and gas activities.

In addition, we have completed the process of negotiating and implementing offshore energy accords with Newfoundland and Nova Scotia. These accords have been enshrined in law and Offshore Petroleum Boards have been established in each province. Agreements in principle on a Northern Accord with the two territories have been signed, and discussions about a potential Pacific Accord with British Columbia have been held. Our objective continues to be the creation of a consistent, equitable and stable regulatory regime for the petroleum industry operating on the frontier lands.

The challenge of the 1990s will be to ensure that a market-oriented and deregulated energy industry is able to respond to public concerns about the protection of the environment through increased government/industry cooperation and research on matters dealing with oil spill prevention and countermeasures.

I look forward in meeting the challenges of the future with you.

T. Epp



Tom Siddon, Minister of Indian and Northern Affairs.

I am pleased to join my colleague, the Honourable Jake Epp, Minister of Energy Mines and Resources, in submitting to Parliament the eighth annual report of the Canada Oil and Gas Lands Administration (COGLA).

1989 was a year of continued progress under the *Northern Political and Economic Framework*. Approved by the federal government in 1987, this framework is based on the principle of joint action with northerners to build a stronger, environmentally sustainable, North. The agreements in principle on a future northern accord signed with the territorial governments in 1988 are an integral part of the framework. In the spirit of these agreements in principle, the territorial governments were consulted prior to the May 1989, decision to proceed with the issuance of new oil and gas exploration rights in the central Beaufort Sea. The issuance of these exploration rights is subject to specific requirements for environmental protection and opportunities for northerners.

Comprehensive environmental protection measures and safeguards have long been in place for northern oil and gas activities. Further refinements for Beaufort Sea exploration activities were made in 1989, following a review of emergency preparedness, relief well and compensation requirements, by the Environmental Impact Review Board, a government-Inuvialuit body.

My government is fully committed to the task of protecting the environmental integrity of the North while continuing to work with all northerners to foster sustainable economic development.

T. Siddon

Canada's Frontier Lands



 Area under the responsibility of the
Minister of Energy, Mines and Resources

 Area under the responsibility of the
Minister of Indian Affairs and Northern Development

A Word from COGLA's Administrator, Maurice Taschereau



Mr. Maurice Taschereau

The northern region was the most active area on the frontier lands in 1989 with 12 active wells, 5 in the Beaufort Sea and 7 on the Mainland Territories. Twenty geophysical projects were carried out in the region during the year by industry in preparation for future drilling and exploration programs.

In the spirit of the September 1988 agreements in principle on a Northern Accord, the federal and territorial governments cooperated to establish terms and conditions for the first issuance of new oil and gas exploration rights in the Beaufort Sea in nearly 20 years. In May the Minister of Indian Affairs and Northern Development called on industry to nominate lands in the Beaufort Sea. After a favorable response by industry, a call for bids was issued in November inviting companies to submit bids for three parcels of land by 9 March 1990. This important initiative will provide industry with new exploration rights throughout the 1990s for the central Beaufort Sea area.

New exploration rights were also issued by the Canada-Newfoundland Offshore Petroleum Board (CNOPB) and the Canada-Nova Scotia Oil and Gas Board on the East Coast. CNOPB issued five exploration licences offshore Newfoundland as a result of a 1989 call for bids. Three exploration agreements were issued to industry by the Canada-Nova Scotia Oil and Gas Board as a result of a call for proposals.

In August the ministers of Indian Affairs and Northern Development, and Energy, Mines and Resources announced the appointments of a chairman and four members to the Oil and Gas Committee. The committee was reactivated to hear two appeals on proposed significant discovery areas near Fort Liard, N.W.T. and in the Beaufort Sea.

In April H. James Strain was appointed Chairman of CNOPB, replacing J.E. (Ted) Baugh upon his retirement. Mr. Baugh played a key role in establishing the board and guiding its development to full operational status.

COGLA continued to consult with industry, governments and CNOPB on regulatory initiatives. Of particular importance is the work on the draft Certificate of Fitness Regulations accomplished by a panel of senior officials from COGLA, the accord provinces and CNOPB. These regulations are part of the federal government's follow-up to the recommendations of the Ocean Ranger Commission. The regulations list organizations which were approved by the panel as Certifying Authorities qualified to certify any type of offshore installation facility in Canada. At year-end the regulations were being reviewed with industry.

This year oil spills off the West Coast and in Alaskan waters, and the resulting public and media attention to the subject, resulted in a thorough reassessment of existing regulatory regimes. While the environmental requirements in COGLA's drilling approval process are among the most stringent in the world, we continue to carefully review all aspects of prevention, containment, contingency planning, countermeasures and compensation provisions for drilling-related pollution.

The joint government-Inuvialuit Environmental Impact Review Board (IERB) conducted its first public hearing on an exploratory well in the Beaufort Sea, Esso Chevron Isserk I-15. The review board made several recommendations which COGLA reviewed and incorporated into the Isserk I-15 drilling program approval. In December we held a workshop with the Inuvialuit on safe drilling practices for offshore oil and gas exploration.

As a result of changes in the frontier lands management regime and the low level of exploration activities, COGLA's size and structure were adjusted to meet ongoing responsibilities. I would like to thank our staff for their continuing support and for a job well done.

A handwritten signature in red ink that reads "Maurice Taschereau".

Federal-Provincial-Territorial Management of the Frontier Lands

Offshore Accords

The federal government signed offshore accords with the Government of Newfoundland and Labrador in 1985, and with the Government of Nova Scotia in 1986. Each accord sets out an arrangement whereby the federal and provincial governments agree to jointly manage petroleum activities in the offshore, and to share revenues from the exploration and development of petroleum resources.

The federal and provincial accord implementation acts incorporate the provisions of the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act, thus ensuring a consistent regulatory regime throughout the offshore areas. As well, the regulations under each accord implementation act correspond closely to those in effect elsewhere on frontier lands.

Each offshore accord establishes an independent board to manage an offshore area on behalf of Canada and the province. The boards are under the authority of federal and provincial energy ministers, who review fundamental decisions of the boards.

COGLA's role in implementing the accords is to help transfer responsibilities to the independent boards and to provide advice and coordination on behalf of the federal energy minister.

Newfoundland and Labrador

The Canada-Newfoundland Offshore Petroleum Board (CNOPB), in St. John's, Newfoundland, regulates the operations of petroleum activities in the Newfoundland offshore on behalf of the Government of Canada and the Government of Newfoundland and Labrador. CNOPB publishes an annual report on its operations for its fiscal year, which ends 31 March.

Mr. H. James Strain was appointed Chairman of CNOPB, effective 17 April 1989. He replaced Mr. J.E. (Ted) Baugh, the board's first chairman, when Mr. Baugh retired.

In 1989 federal, provincial and CNOPB representatives finalized a memorandum of understanding (MOU), which sets out roles and responsibilities of CNOPB and government departments and agencies for industrial and employment benefits matters with respect to the design and construction of offshore projects. At year-end the MOU was being circulated to federal and provincial ministers and the CNOPB chairman for signature. In addition, MOUs on marine safety, and occupational health and safety were finalized by federal and provincial government agencies and the board.

During 1989 negotiations continued between the Government of Canada, the Government of Newfoundland and Labrador, and the Hibernia Project consortium on a final agreement to develop the Hibernia oilfield offshore Newfoundland. An agreement is expected in 1990 and initial production is scheduled to begin in 1996.

Federal-Provincial-Territorial Management of the Frontier Lands

Nova Scotia

The Canada-Nova Scotia Offshore Oil and Gas Board, established under the 1982 Canada-Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing, met for the last time in June.

The Oil and Gas Board will be replaced by a new Canada-Nova Scotia Offshore Petroleum Board when the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and corresponding provincial legislation are proclaimed in 1990.

At year-end, the federal and provincial governments were considering appointments to the new board. The board will comprise a jointly appointed chairperson and four part-time members, two appointed by each government.

British Columbia

The federal and provincial governments continued to follow up on the various recommendations of the West Coast Offshore Exploration Environmental Assessment Panel Report. At year-end the prohibitions on offshore petroleum exploration activity were still in effect.

Northwest Territories and Yukon

In September 1988 the Government of Canada and the governments of Yukon and the Northwest Territories signed agreements in principle for a Northern Accord. In the spirit of these agreements, throughout 1989 COGLA officials consulted regularly with representatives of both governments on regulatory decisions. COGLA also briefed officials of each government on regional geology, resource potential, significant discoveries, existing rights and current regulatory processes.

Rights Management



COGLA issues, regulates and registers oil and gas exploration and production rights in Canada's North and in offshore frontier areas not overseen by regional boards, under the authority of the ministers of Indian Affairs and Northern Development, and Energy, Mines and Resources. COGLA also administers federal mineral rights situated within the provinces under the authority of the Minister of Energy, Mines and Resources.

In May COGLA issued a call for nominations in the central Beaufort Sea, signaling to industry that the Minister of Indian Affairs and Northern Development, in cooperation with the two territorial governments, was preparing to issue oil and gas exploration rights in the Beaufort Sea. Previous exploration rights in the area were awarded 20 years ago. The call for nominations closed in September and subsequently a call for bids for three parcels, comprising more than 100 000 hectares, was issued. The call will close 9 March 1990. The sole bidding criterion to be used to assess and select successful bids is the total amount of money the bidder proposes to spend in the first four years of the term of the licence.

Elsewhere, six exploration licences and three exploration agreements were issued in 1989. Following a call for bids that closed in September, CNOPB awarded five exploration licences offshore Newfoundland. CNOPB received total work expenditure bids of more than \$49 million for the call.

A second generation exploration licence was issued in the Beaufort Sea to Gulf Canada Resources Ltd. The licence requires the drilling of three wells during the four-year term.

Following a call for proposals that ended in June, the Canada-Nova Scotia Offshore Oil and Gas Board awarded three exploration agreements for rights near Sable Island. The board received total work expenditure bids of more than \$19 million.

COGLA issued six significant discovery licences (SDLs) in 1989 related to significant discovery area (SDA) declarations in the central Beaufort Sea.

At year-end, industry held 5.69 million hectares of frontier lands, comprising 49 exploration agreements and exploration licences, 98 SDLs and 2 production licences.

CNOPB administered rights held under 11 exploration licences and 10 SDLs. The Canada-Nova Scotia Oil and Gas Board administered rights held under 3 new exploration agreements and 22 SDAs.

In 1989 COGLA continued to consult industry, accord provinces, territorial governments and offshore boards on developing regulations under the Canada Petroleum Resources Act for royalties, surveys and Canadian ownership, and on related guidelines, forms and procedures.

Rights Management

FRONTIER LAND HOLDINGS AT YEAR-END, 1989

	1985	1986	1987	1988	1989
Number of Licences/Agreements Active*	150	118	112	153	149
Lands Negotiated into Licences/Agreements (millions of ha)	24.9	4.1	7.3	2.31	0.56
Lands Relinquished or Surrendered (millions of ha)	20.0	39.2	15.1	16.5	2.37
Lands Active (millions of ha)	70.8	33.5	20.6	7.1	5.69

* Includes exploration licences, exploration agreements, significant discovery licences and production licences.

LAND STATUS AT YEAR-END, 1989

	Active Licences/ Agreements*	Lands Relinquished or Surrendered (millions of ha)	Lands Nego- tiated into Licences/ Agreements (millions of ha)	Lands Active (millions of ha)	Pending Lands**
Mainland Territories	25	0.38	0	0.9	1.1
Mackenzie Delta and Beaufort Sea	62	1.4	0.2	2.5	0
Arctic Islands and Eastern Arctic Offshore	24	0.17	0	1.29	2.4
Hudson Bay	0	0	0	0	1.4
Newfoundland Offshore	21	0.3	0.26	0.76	1.5
Nova Scotia Offshore (Includes Gulf of St. Lawrence)	17	0.12	0.1	0.24	3.4
West Coast	0	0	0	0	8.7
Total	149	2.37	0.56	5.69	18.5

* Includes exploration licences, exploration agreements, significant discovery licences and production licences.

** 'Pending' includes areas where exploration activity has been suspended: West Coast, Baffin Bay, Georges Bank, St. Pierre and Miquelon, etc.

LICENCES/AGREEMENTS NEGOTIATED IN 1989

Operating Company	Licence/Agreement	Number of Licences/Agreements*	Area (thousands of ha)	Location	Term (years)
Gulf	EL 351	1	244	Beaufort Sea	4
LASMO	EA 352	1	26	Nova Scotia	6
Nova Scotia Resources	EA 353	1	18	Nova Scotia	6
Mobil	EA 354	1	55	Nova Scotia	6
Gulf	SDL 083-088	6	42	Beaufort Sea	—
Esso Resources (1989)	EL 1003	1	42	CNOPB	6
Shell	EL 1004	1	52	CNOPB	6
Petro-Canada	EL 1005	1	55	CNOPB	6
BP Resources	EL 1006	1	37	CNOPB	6
Petro-Canada	EL 1007	1	77	CNOPB	9

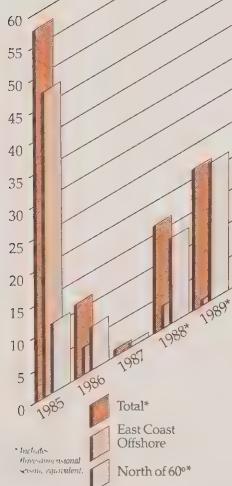
* Includes exploration licences and significant discovery licences.

Exploration Activity



Esso Chevron et al. Nipterk P-32 drilled from an artificial ice island in the Beaufort Sea.
Courtesy, K. Singh.

Reflection Seismic Shot on Frontier Lands 1985-1989 (thousands of km)



In 1989, 14 exploratory wells were active on frontier lands. This was a decrease over 1988, and reflected the trend toward decreasing activity on frontier lands because of low oil prices and shrinking land holdings. Exploration activity highlights included the continuing exploratory work in the Beaufort Sea and the announcement of significant discoveries in the Beaufort Sea and in the Newfoundland offshore.

Geophysical activity remained at the same level as in 1988, and occurred in all areas except the Arctic Islands and offshore Newfoundland.

The North

Almost all of the frontier geophysical work and 12 of the 14 active wells on Canada's frontier lands were in the North in 1989, with the highlight being the continued exploration activity in the Beaufort Sea, particularly the western portion.

Beaufort Sea and Mackenzie Delta

Ice and weather conditions during the summer were generally good for collecting data. A total of 11 geophysical surveys were conducted, including two site-specific surveys and one three-dimensional seismic survey. Esso completed two small seismic surveys, a well-site survey in the Beaufort Sea, and one seismic survey onshore in the Mackenzie Delta. Shell conducted three surveys onshore in the Mackenzie Delta, including a three-dimensional seismic survey in the Niglintgak area. Amoco ran two surveys offshore, including a site survey, and Geophysical Services Inc. conducted a large regional survey in the Beaufort Sea. Chevron completed a small survey in the shallow waters north of Richards Island.

Four exploratory wells were completed in 1989, all in the Beaufort Sea. Esso Chevron et al. Nipterk P-32 was drilled from an artificial spray ice island north of Richards Island. The ice island was constructed in 6.5 m of water, making it the deepest spray ice island in the Canadian Beaufort Sea to date. It had a working surface diameter of 75 m, with a total diameter of 380 m. The well was completed in two months and was abandoned as an oil and gas discovery.

On 5 June the operator drilling the Gulf et al. Immugak N-05 well in the Beaufort Sea encountered a shallow pocket of high-pressure natural gas, which blew the drilling fluid from the well-bore and escaped to the surface. The drilling unit, *Kulluk*, was evacuated when the flow could not be controlled, and was later removed from the well location because of deteriorating ice conditions. The operator, Gulf, moved the *Kulluk* slightly to the northeast and drilled Immugak A-06, which was deviated to encounter the same primary objectives as N-05. The well was abandoned and the operator is keeping the results confidential.

Amoco et al. Kingark J-54 was also drilled in the Beaufort Sea, approximately 20 km northeast of the 1986 Adlartok oil discovery. Severe overpressuring problems occurred during drilling, so the operator required additional time to drill and test the well. The Kingark well was abandoned and data from this well remain confidential.

At year-end Esso Chevron et al. Isserk I-15 had reached a total depth of 2693 m and was undergoing evaluation.

Mainland Territories

Geophysical activity in the mainland territories increased slightly in 1989 with a total of nine geophysical projects, six of which were seismic, totaling 1600 km of new reflection data. In the Fort Good Hope area, Chevron undertook three programs involving gravity, resistivity and seismic surveys. Petro-Canada and Shell each conducted two seismic programs. Unocal conducted a small seismic project, and Northcor extended its large aeromagnetic survey of 1988.

Four exploratory wells were terminated in 1989. Shell et al. Arrowhead B-41, just north of the B.C.-N.W.T. border, was drilled to 3080 m and was suspended as a gas discovery. Conoco et al. Little Bear O-51, located south of Norman Wells, was abandoned without testing.

Paramount drilled two new wells in the Cameron Hills area, Paramount et al. Cameron L-47 and Cameron B-08; both wells were suspended for further evaluation in the upcoming drilling season. In addition, Paramount reentered the Cameron Hills I-10 well, drilled in 1986, to conduct more tests. Results from all three Cameron Hills wells remain confidential. Paramount et al. Cameron L-44 was spudded late in the year.

Chevron Mountain River O-18 was spudded in late November in the Fort Good Hope area and was drilling at year-end.

Arctic Islands

No geological, geophysical or drilling activity took place in 1989.

East Coast Offshore

Highlights of the East Coast offshore in 1989 include a successful gas discovery in the Jeanne d'Arc Basin, offshore Newfoundland, and a reflection seismic survey on the Scotian Shelf in the Cohasset area.

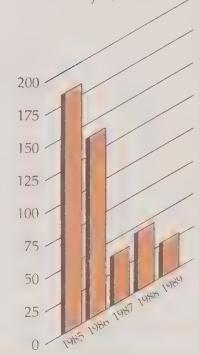
Newfoundland Offshore

In 1989 two exploratory wells were drilled in the Newfoundland offshore, completing a three-well drilling program started by Texaco in 1988. Texaco et al. Amethyst F-20 was drilled on the east side of the Jeanne d'Arc Basin, about 10 km northeast of the 1986 oil discovery at Fortune G-57 and was abandoned without testing. Texaco et al. Springdale M-29 was drilled on the southeastern edge of the Jeanne d'Arc Basin and tested gas at rates of up to 331 000 m³ per day.

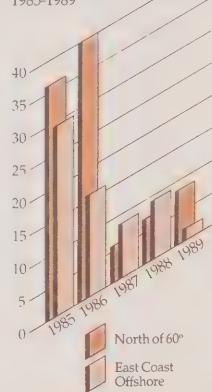
Nova Scotia Offshore

In 1989 LASMO Nova Scotia Ltd., a new operator on Canada's East Coast, and Nova Scotia Resources Ltd., conducted a regional seismic survey east of the Cohasset oil discovery. LASMO is evaluating its newly acquired exploration agreement. No exploratory or delineation wells were drilled offshore Nova Scotia in 1989.

Exploratory and Delineation Drilling on Frontier Lands 1985-1989 (thousands of m)



Number of Wells Terminated 1985-1989



Resource Evaluation Activities



Chevron conducting a seismic survey near Fort Good Hope, N.W.T.

Courtesy, Chevron Canada Resources Ltd.

Evaluation of Hydrocarbon Potential

In 1989 COGLA and the Institute of Sedimentary and Petroleum Geology embarked on two regional assessments of hydrocarbon resources: the part of the Western Canada Gas Assessment that extends into the Northwest Territories and Yukon to 62°N, and an assessment of the oil and gas potential of the Mackenzie Corridor. COGLA also reviewed drafts of the offshore Newfoundland Jeanne d'Arc Basin Assessment.

COGLA evaluated the results of geoscientific research in the Queen Charlotte Islands and Hecate Strait offshore British Columbia for hydrocarbon potential in the Queen Charlotte Basin, particularly the offshore area east of the proposed South Moresby Island marine park.

As part of its contribution to land-use planning in the Mackenzie Delta-Beaufort Sea region, COGLA prepared maps illustrating hydrocarbon prospectivity and development potential. COGLA also contributed technical information to the Mackenzie/Delta Geological Atlas, which is being developed by the Geological Survey of Canada. Also in 1989, COGLA conducted diverse studies on petroleum geology, geophysics and hydrocarbon potential, particularly in basins where exploration has been active (e.g., Beaufort/Mackenzie basin, the Mackenzie Corridor and the southern territories). These studies support many of COGLA's resource management responsibilities and have been aided by COGLA's computer-based data-handling systems.

Research

COGLA actively promotes research into improved techniques to evaluate wells drilled with oil-based mud. Two research contracts are under way that address concerns regarding the organic geochemistry and biostratigraphy of samples from such wells.

Oil and Gas Committee

In August the Minister of Indian Affairs and Northern Development and the Minister of Energy, Mines and Resources jointly announced the appointments of Dr. Edward (Ted) Best as chairman, and Laura Jean Nelson, Steven Malcolm Millan, Jacques Farmer and John Boyd as members of the Oil and Gas Committee. The committee is a quasi-judicial body that hears appeals and holds inquiries on technical matters relating to the Oil and Gas Production and Conservation Act, and advises the ministers on issues relating to the Canada Petroleum Resources Act. At year-end, the committee was preparing to hear appeals from two companies about proposed SDAs near Fort Liard, N.W.T. and in the Beaufort Sea.

Conservation and Development



Mainland Territories

Norman Wells

The waterflood project continued to show improvements, with an increased oil rate and reservoir pressure, and a decreased gas-oil ratio.

Aside from routine workovers, the only significant well activity was the conversion of one producer to an injector, which changed the field well count to 166 producers and 155 injectors.

Oil production in 1989 totaled 1.789 million m³, an increase from 1.728 million m³ in 1988. The daily average oil production rate increased slightly to 4900 m³ per day. At year-end, cumulative oil production from the field was 12.138 million m³. This cumulative amount includes an increase of 1.083 million m³ due to recalibration of the 1988 production data.

Gas production continued to decline, with 129 million m³ produced in 1989, compared with 138 million m³ produced in 1988.

Pointed Mountain

In 1989 gas production from the Pointed Mountain gas field declined to 103 million m³, representing a 33 per cent reduction over 1988. Cumulative gas production at year-end totaled 8.088 billion m³.

Kotaneelee

Plans have been made to modify the gas plant at Kotaneelee, Yukon, in anticipation of better opportunities for gas contracts. The changes will improve plant efficiency and reduce the time necessary for plant start-up if gas contracts are negotiated.

Beaufort Sea - Mackenzie Delta

Mackenzie Delta Gas Export Project

Esso, Shell and Gulf each applied to the National Energy Board for export licences to carry natural gas from the Mackenzie Delta and Beaufort Sea to the United States. The licences would be for 20 years, beginning 1 November 1996. The producing companies expect to export 260 billion m³ of gas. The fields will provide a sales rate of 34 million m³ per day. COGLA completed a reservoir engineering analysis of the Taglu gas field and initiated a similar study on the Parsons Lake gas field.

Arctic Islands

Bent Horn

Panarctic again made two shipments of seasonal production from its Bent Horn oil field on Cameron Island. The first shipment of 24 637 m³ left 5 September on the *MV Arctic*. About 1900 m³ of the crude was transferred to the tanker *MV Ours Polaire* for use in Resolute; the rest was transferred to the *MV Kmir*, a Norwegian-registered vessel, which delivered the oil to Statoil in Denmark.

The *MV Arctic* picked up a second shipment of 18 444 m³ on 24 September. Heavy ice in the area prevented the vessel from taking more crude in the second shipment. The crude was later transferred to the *MV Don*, a Norwegian-registered vessel, destined for Statoil.

Oil production from Bent Horn this year totaled 43 373 m³. Cumulative production from the Bent Horn field is 180 000 m³.

Nova Scotia Offshore

Cohasset and Panuke

LASMO and Nova Scotia Resources are preparing plans to produce oil from the Cohasset and Panuke discoveries, and are expected to submit a formal development plan application in 1990. Production could begin in 1992.



Bladders being filled with Bent Horn crude prior to loading into a tanker for shipment.
Courtesy, G. McCormick.

Protection of the Worker



COGLA personnel inspecting H,S sensors at the Paramount et al. Cameron B-08 well site.
Courtesy, K. Singh.

In 1989 COGLA worked with the accord provinces and CNOPB to complete the legislative drafting instructions for safety amendments to the Oil and Gas Production and Conservation Act, the Atlantic Accord and the Canada-Nova Scotia Accord implementation acts. Once enacted, these proposed safety amendments will put into legislation the recommendations from the Royal Commission on the Ocean Ranger Marine Disaster that still require statutory implementation. The amendments include:

- a Certificate of Fitness system to ensure that facilities and equipment used by industry are verified as fit for service by a third party;
- a requirement that each offshore installation be under the command of an offshore installation manager who will be responsible for the safety of personnel and the facility or installation;
- a council to ensure consistent regulatory practices;
- temporary emergency power to the energy minister; and
- provisions to enhance the role of officers who inspect the safety of operations.

The Department of Justice is now drafting the proposed amendments into legislation.

Occupational Safety and Health

After extensive consultation with industry, COGLA published the Oil and Gas Occupational Safety and Health Guidance Notes in June. They give information to employers, employees and contractors on frontier lands to help them meet the requirements in Part II of the Canada Labour Code and its regulations. In particular, the document offers guidelines for forming safety committees and procedures to follow when employees refuse to do work they consider dangerous. The guidelines were sent to all oil and gas operators on the frontier lands.

In 1989 the drafting of the Newfoundland Petroleum Occupational Safety and Health Regulations was completed by COGLA and the Newfoundland Department of Mines and Energy. Industry also reviewed the regulations, which are similar to the federal Occupational Safety and Health Regulations. The regulations have now been finalized and will likely be promulgated in 1990.

Production

The draft Production Installation Regulations were renamed the Installations Regulations, and amended by COGLA to cover drilling, accommodation and production installations. These regulations include technical requirements for designing, constructing, installing, operating and maintaining an installation.

Certification

The Certificate of Fitness Regulations were drafted by COGLA and sent to industry for comments. These regulations are part of the certification process recommended by the Ocean Ranger commission and the subsequent Harrison Task Force Report. The regulations list organizations approved as certifying authorities (CAs), outline procedures for issuing a Certificate of Fitness, and include the minimum scope of work to be carried out by the CA.

During 1989 an executive panel was convened to hear applications for organizations wanting recognition as CAs. The panel included senior officials from COGLA, the Newfoundland Department of Mines and Energy, the Nova Scotia Department of Mines and Energy, and CNOPB.

Important criteria in the qualification review process established by the panel were that CAs must have enough certification experience, resources and qualified staff to certify any offshore installation in Canada, and must be able to conduct surveys to ensure that an operator can maintain a valid Certificate of Fitness.

After evaluating several qualified organizations, the panel recommended the following companies be included in the Schedule of Recognized Certifying Authorities, which will be included in the proposed Certificate of Fitness Regulations:

- American Bureau of Shipping;
- Bureau Veritas;
- Det Norske Veritas; and
- Lloyd's Register of Shipping.

Standards for Survival Suit Systems

COGLA chairs the Survival Suits Committee, which is responsible for developing survival suit standards. As a result of the work of that committee, in 1989 the Canadian General Standards Board published standards for marine abandonment immersion suit systems and for marine anti-exposure work suit systems. Operators have a reasonable amount of time to comply with these standards.



Safety Training

In 1989 COGLA, CNOPB and industry continued to develop training and qualification guidelines describing the minimum safety and industrial training required by mobile offshore drilling unit (MODU) personnel and standby vessel crews. These guidelines will help operators apply the training provisions of various occupational safety and health, marine and drilling regulations. These guidelines received general support from industry and will be published in 1990.

Also in 1989 COGLA extended the Survival Training Guidelines to include all regular northern offshore workers. This training gives personnel a basic understanding of the hazards associated with the offshore environment, and training in emergency equipment and in skills needed to react effectively to offshore emergencies. Industry accepted the guidelines and a standard training program was developed with the Pacific Marine Training Institute, the delivery agency of the program, in Vancouver. At year-end, most northern offshore personnel had taken the course.

Drilling crew reboarding the Kulluk at the Immiugak N-05 well site in the Beaufort Sea.
Courtesy, D. Scratch.

Protection of the Worker



Abandonment operation under way at the Briggs N.E. Tatlayina Lake No. 1 well in the Northwest Territories. Courtesy, F. Lepine.

Diving

During 1989 COGLA completed work on 10 sets of diving training guidelines and requirement standards, to meet specific sections of the Canada Oil and Gas Diving Regulations. These guidelines will require uniform training for divers and other diving personnel to ensure that diving operations on frontier lands are safe. All training guidelines will be published and distributed in early 1990.

Blowout Prevention Committee

COGLA serves on the Blowout Prevention and Well Control Examination and Certification Committee, a body that includes representatives from provincial regulatory agencies and industry. In 1989 the committee revised the course content for the certification of personnel on land wells. As well, the committee now allows candidates with valid land certificates the flexibility to take the offshore, severe service (H_2S) or well service courses as refresher courses. In late 1989 the committee initiated a review of the courses required for offshore certification.

Marine

In 1989 the Canadian Coast Guard, with COGLA's participation, completed drafting the Certification and Manning Regulations, which outline the training qualifications and manning requirements of marine supervisory staff on MODUs or production vessels. They are expected to be promulgated in 1990.

Inspections

As part of COGLA's mandate to ensure the safety and health of employees and the effectiveness of oil and gas operations on frontier lands, periodic inspections are carried out on all exploration and production sites. In 1989, 3 geophysical, 25 drilling and 5 production facilities were inspected on the frontier lands.

Lost-Time Accidents

In 1989 a total of 21 lost-time accidents (LTAs) on exploration sites and standby vessels were reported to COGLA safety officers. This resulted in an increase in the incidence of LTAs to 18.6 per million person-hours worked, from 15.1 in 1988. In addition, 1 production and 10 geophysical-related LTAs occurred on the frontier lands. There were no fatalities associated with oil and gas exploration or production during the year.

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1989

	Person-Hours at Work Site		Lost-Time Accidents		Accident Rate	
	Drilling Unit	Standby/Supply Vessel	Drilling Unit	Standby/Supply Vessel	Drilling Unit	Standby/Supply Vessel
(LTA/Millions of Person-Hours)						
Mainland Territories	90 997	—	1	—	11	—
Mackenzie Delta* and Beaufort Sea	565 054	289 944	8	4	14.16	13.80
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—
Newfoundland Offshore	125 388	56 124	6	2	47.85	35.64
Nova Scotia Offshore	—	—	—	—	—	—
Total	781 439	346 068	15	6		

* Estimated.

Well Control Problem at Immiugak N-05

COGLA investigated the Immiugak N-05 well control problem and published a report in December. The investigators recommended that operators use all available seismic and drilling data when deciding on the location for a well; that they continue to use pilot holes, reserve mud volumes and diverters in areas where there is a hazard of shallow gas; and that diverters be specially designed for each MODU. The report also recommended a workshop for northern operators be held in 1990 to discuss methods and equipment for drilling safely through suspected shallow gas zones.

Abandonment of Briggs Well

In January COGLA contracted Petro-Canada to abandon properly the Briggs N.E. Tathlina Lake No. 1 well in the Northwest Territories. Drilled in 1956, this well had leaked small amounts of sour gas in recent years. Usually the original operator must correct deficiencies in a well abandonment. However, in this case the operator had been out of business for several years. COGLA inspectors surveyed the drill site and found measurable amounts of hydrogen sulphide, a potential hazard to humans and wildlife, so temporary warning signs were erected to keep the public away from the site. The well was reentered and the hole cemented to the surface.

Protection of the Worker



Helicopter simulator used for underwater escape training of offshore personnel. Courtesy, Survival Systems Ltd.

Research and Development

Under the Panel for Energy Research and Development (PERD), COGLA continued to chair the Task 6.2 Marine Engineering Committee, which funds programs in environmental design criteria, marine engineering, ice-structure interaction and personnel safety. These programs address problems in designing and operating oil and gas exploration and production facilities. Research results will improve technologies in the oil and gas industry and will enhance the safety requirements of regulations and guidelines.

The major projects sponsored by PERD and managed by COGLA are described below.

Spray Ice Island Protection

COGLA participated in a joint government-industry field research program that was designed to extend the life of artificial ice islands built for normal exploration or relief well drilling. The project determined the surface ablation and erosion rates, and investigated the stability of the edges of spray ice islands after various protection systems are implemented.

The project was conducted on the Nipterk P-32 artificial spray ice island, and assessed many insulation and protection techniques. The results are expected to allow industry to design ice islands that can be used for longer periods, and that have improved design safety features.

Wave Effects on the Seabed

COGLA began this project to improve physical and numerical modeling techniques for predicting erosion and seabed response around caisson-type structures. The 1989 program focused on developing software to predict pore pressure fluctuations and sediment suspension around the front of the caisson. The new software is being calibrated with laboratory model tests. Industry and government will use the software to design and review caisson-type structures in the Beaufort Sea.

Evacuation Technology

Because offshore drilling units are primarily evacuated by helicopter, two studies were conducted to address various aspects of helicopter passenger safety. In 1989 a two-year study was completed on factors that impede and promote a passenger's escape from a downed flooded helicopter. A second program assessed simple devices that improve a passenger's chances of surviving an offshore helicopter accident.

Another project involved assessing whether having motion sickness for prolonged periods of time (36 hours) endangers the lives of those who evacuate drilling units in totally enclosed motor-propelled survival craft. The results indicated that seasickness leads to dehydration and a loss of body electrolytes, but is unlikely to cause death directly.

Polar Lows

Although much work has been done on predicting polar lows and their occurrence over the Barents and North seas, little is known about their occurrence, frequency and behavior over Canadian waters. In 1989 COGLA sponsored a new three-year project to study polar lows over Canadian waters. A meteorological database of polar lows events was developed, as well as a climatology of these rapidly developing storms over Canadian waters. This work will be used to prepare a forecaster's handbook to help predict polar lows, which will improve the safety of offshore operations.



*The totally enclosed motor-propelled survival craft was the subject of a motion sickness study undertaken by COGLA.
Courtesy, S. Gill.*

Protection of the Environment



Polar bears on Ellesmere Island
in the High Arctic.
Courtesy, Canadian Parks
Service, Environment Canada.

East Coast

Georges Bank

Consistent with a 1988 moratorium on offshore drilling on Georges Bank until the year 2000, COGLA met with participants of the Canada-U.S. Georges Bank Consultative Network to discuss environmental and socioeconomic concerns about drilling on Georges Bank. Participants exchanged information on environmental, scientific and technical research initiatives now under way in both countries.

West Coast

Environmental Review

The Pacific Environmental Coordinating Committee (PECC) met during the year to establish priorities for several study initiatives on offshore exploration. The committee awarded a contract to develop a coastal resource and sensitivity information system.

The Socio-Economic Advisory Committee (SEAC), jointly chaired by representatives from the B.C. Ministry of Energy, Mines and Petroleum Resources and COGLA, met to develop a formal work program. Both SEAC and PECC continued to address environmental and socioeconomic recommendations made by the West Coast Offshore Exploration Environmental Assessment Panel.

North

Isserk I-15 Public Review

In October COGLA participated in the Inuvialuit Environmental Impact Review Board (EIRB) public hearings in Tuktoyaktuk to review the proposed Esso Chevron et al. Isserk I-15 drilling program. It was the first public review by EIRB in accordance with the Inuvialuit Final Agreement. The review focused on the government's enforcement of same-season relief well drilling policy, concerns about oil spill cleanup efficiency and compensation for any harm to wildlife harvest. The board concluded that the project could begin under several specific conditions, which were incorporated into the drilling program approval of the Isserk I-15 well. The board also recommended measures to encourage the participation of the Inuvialuit people in development projects.

Land-Use Planning

During 1989 COGLA worked closely with the Mackenzie Delta-Beaufort Sea and Lancaster Sound Regional Land-Use Planning commissions. COGLA helped review the final draft of the Lancaster Sound Plan, and gave technical and regulatory information on exploration and production operations for the Mackenzie Delta-Beaufort Sea Plan. COGLA also participated in workshops in Inuvik on developing nonrenewable resources. COGLA began discussions with the recently established Denendeh Regional Land-Use Planning Commission over a similar land-use plan for the Dene-Métis settlement area.

Canadian Coast Guard-Beaufort Sea Oil Spill Cooperative Summer Exercise

COGLA inspected the field exercise in Tuktoyaktuk staged jointly by the Canadian Coast Guard and the Beaufort Sea Oil Spill Cooperative. The exercise demonstrated various types of oil spill equipment, including the testing of a new heli-torch capable of igniting oil. The exercise revealed that the personnel involved in the exercise were competent, well trained and familiar with all oil spill countermeasure equipment.

Major Pollution Incident Workshop

COGLA and other federal and territorial agencies held a planning workshop in September for a major pollution incident in the Arctic Seas Region. The agencies reviewed contingency plans of the key government agencies and resource departments to determine whether coordination provisions were adequate, and to identify possible improvements. Future consultations are being considered to improve coordination among agencies.



Consultations

Guidelines

In consultation with government departments, oil and gas boards and the industry, COGLA published the Offshore Waste Treatment Guidelines for offshore hydrocarbon exploration and development. The Drilling Fluids Lubricant Task Force will also publish in the new year its report on the environmental effects of using diesel oil as a drilling fluid lubricant. COGLA continued to consult with the oil industry in 1989 to develop strategies for oil-spill monitoring.

COGLA personnel at the EIRB public hearings on the Esso Chevron et al. Isserk I-15 drilling program. Courtesy, F. Lepine.

Protection of the Environment



Seatruck assisting in the deployment of boom and skimmer during the Beaufort Sea summer oil spill exercise.
Courtesy, Department of Fisheries and Oceans.

Tanker Safety and Pollution Response Capability

During 1989 the federal government began an interdepartmental review of tanker safety and pollution response capability. The same terms of reference were given to the three-member Public Review Panel, which solicited input from the public. COGLA was involved in the interdepartmental review as a member of the policy and preparedness teams, particularly in those areas concerning liability and pollution response capabilities in offshore oil and gas activities. As well, COGLA presented relevant data on pollution incidents from offshore drilling operations to the Public Review Panel hearing in Inuvik.

Environmental Studies Research Funds

Begun in 1983, the Environmental Studies Research Funds (ESRF) is a research program pertaining to oil and gas exploration and development, funded by oil and gas interest-holders on Canada's frontier lands. The program is managed by a board of representatives from the industry, the federal government, regional boards and the public, supported by a COGLA Secretariat which administers the program. Michael R. Robertson of Petro-Canada was selected as chairman of the ESRF board. He is the first industry representative to serve in the position.

In 1989 ESRF undertook a \$500 000 study program in six areas:

- investigating through a numerical model, possible effects of hydrocarbons on the distribution of Grand Banks fish eggs and larvae;
- examining the potential for tainting commercial species of Grand Banks flatfish in the event of an oil spill;
- designing an environmental effects monitoring program for the Beaufort Sea;
- archiving marine radar data on iceberg detection on the Grand Banks;
- designing an ice scour repetitive mapping program for the Grand Banks; and
- analyzing hindcasting extreme waves in the Beaufort Sea.

Employment and Industrial Benefits

On-land and offshore activities created 2319 jobs in 1989. In the North, 2129 jobs were created; all but 10 were filled by Canadians. On the East Coast Canadians filled 175 jobs out of a total of 190.

In 1989 foreign business groups and governments continued to express interest in the opportunities in Canada's offshore development. Many groups came to Canada to learn more about these opportunities; others formed joint ventures with Canadian companies. COGLA gave presentations to the Association of British Offshore Industries and to Canadian and Norwegian companies that participated in seminars sponsored by the Canada-Norway Offshore Working Group.

Northern Developments

The November call for bids for parcels of lands in the central Beaufort Sea provided the federal, the N.W.T. and Yukon governments an opportunity to work together in implementing benefits provisions of the Northern Accord's agreements in principle. Under these provisions, the territorial governments will monitor northern benefits while the federal government monitors national benefits. With few exceptions, benefits for northern exploration programs are national, since expenditures and labor are concentrated in Western Canada and the North.



Megaproject Negotiations

COGLA officials assisted Energy, Mines and Resources in the negotiations of the benefits provisions of four megaproject agreements: Other Six Leases Operation (OSLO), the Vancouver Island Natural Gas Pipeline project, the Lloydminster heavy oil upgrader project and Hibernia.

The nerve-centre of the Norman Wells oilfield, the Central Processing Facility control room, with operator John Charlie, a native of Fort McPherson, N.W.T. Courtesy, Esso Resources Canada Limited.

Employment and Industrial Benefits

TOTAL 1989 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total Work Force*	Canadian	Per Cent Canadian
Mainland Territories	675	675	100
Mackenzie Delta and Beaufort Sea	1 431	1 421	99
Arctic Islands and Eastern Arctic Offshore	23	23	100
Newfoundland Offshore	150	136	91
Nova Scotia Offshore	40	39	98
Total	2 319	2 294	99

* Represents approximate number of jobs created.

TOTAL 1989 PETROLEUM EXPENDITURES ON FRONTIER LANDS

	Exploration*	Development	Production (millions of \$)	Total	Canadian	Per Cent Canadian**
Mainland Territories	24.1	—	—	24.1	22.9	95
Mackenzie Delta and Beaufort Sea	233.2	—	—	233.2	198.2	85
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—
Newfoundland Offshore	29.4	—	—	29.4	17.6	60
Nova Scotia Offshore	0.7	—	—	0.7	0.6	86
Total	287.4	—	—	287.4	239.3	83

* Includes geophysical expenditures.

** Estimates.



Statistical Summary

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Frontier Lands

Statistical Summary

ACTIVITY STATUS ON FRONTIER LANDS	1985	1986	1987	1988	1989
Licences/Agreements (ELs/EAs/SDLs)					
Concluded	5	23	42	105	15
Wells Spudded	99	60	48	25	12
Metres Drilled	207 896	150 404	67 234	54 391	27 014
Wells Terminated	103	70	50	27	10
Significant Discoveries	25	14	1	2	3*
Geophysical Programs Run	55	15	7	27	21
Reflection Seismic km	57 091	11 001	2 756	16 568	21 587
Rig-Months	199	133	41	37	18

* In addition, results of four exploratory wells remain confidential.

FRONTIER LANDS RESOURCE INVENTORY	OIL*		GAS	
	Discovered	Potential (millions of m ³)	Discovered	Potential (billions of m ³)
West Coast	0	50	0	270
Mainland Territories	37.7	95	21.8	312
Mackenzie Delta and Beaufort Sea	256.4	1 112	322.7	1 918
Arctic Islands and Eastern Arctic Offshore	65.7	873	416.4	3 156
Hudson Bay	0	127	0	88
Newfoundland Offshore	235.2	894	148.7	1 649
Nova Scotia Offshore	23.7	318	164.7	663
Total	618.7	3 469	1 074.3	8 056

* Includes condensate.

OIL AND GAS PRODUCTION ON FRONTIER LANDS	1985	1986	1987	1988	1989
Oil Production (thousands of m ³)					
Norman Wells	949	1 411	1 531	1 728	1 789
Bent Horn	29.5	17.5	34.5	54.9	43.4
Amauligak	—	50	—	—	—
Panuke	—	—	3.7	—	—
Gas Production (millions of m ³)					
Pointed Mountain	226	205	156	154	103
Norman Wells	227	188	163	138	129

Mainland Territories

Statistical Summary



ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded					
Exploratory/Delineation	15	14	1	3	6
Development	39	14	35	11	—
Total	54	28	36	14	6
Wells Terminated*					
Exploratory/Delineation	17	14	2	3	4
Development	38	14	36	11	—
Total	55	28	38	14	4
Metres Drilled	53 924	36 289	31 132	15 778	9 865
Exploratory/Delineation	23 968	24 401	974	7 095	9 865
Development	29 956	11 888	30 158	8 683	—
Geophysical Programs Run	17	7	5	9	9
Reflection Seismic km	5 819	2 095	149	1 729**	1 600

* In the Mainland Territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be reentered in the following year for testing.

** Includes three-dimensional seismic equivalent.

RESOURCES STATUS	1985	1986	1987	1988	1989*
Discovered Resources**					
Gas (billions of m³)	21.4	20.3	20.8	20.8	21.8
Oil (millions of m³)	51.0	51.0	37.2	37.2	37.7
Gas and Oil Production					
Pointed Mountain Gas (millions of m³)	226	205	156	154	103
Norman Wells Gas (millions of m³)	227	188	163	138	129
Norman Wells Oil (thousands of m³)	949	1 411	1 531	1 728	1 789

* Includes new discoveries and revisions to previous estimates.

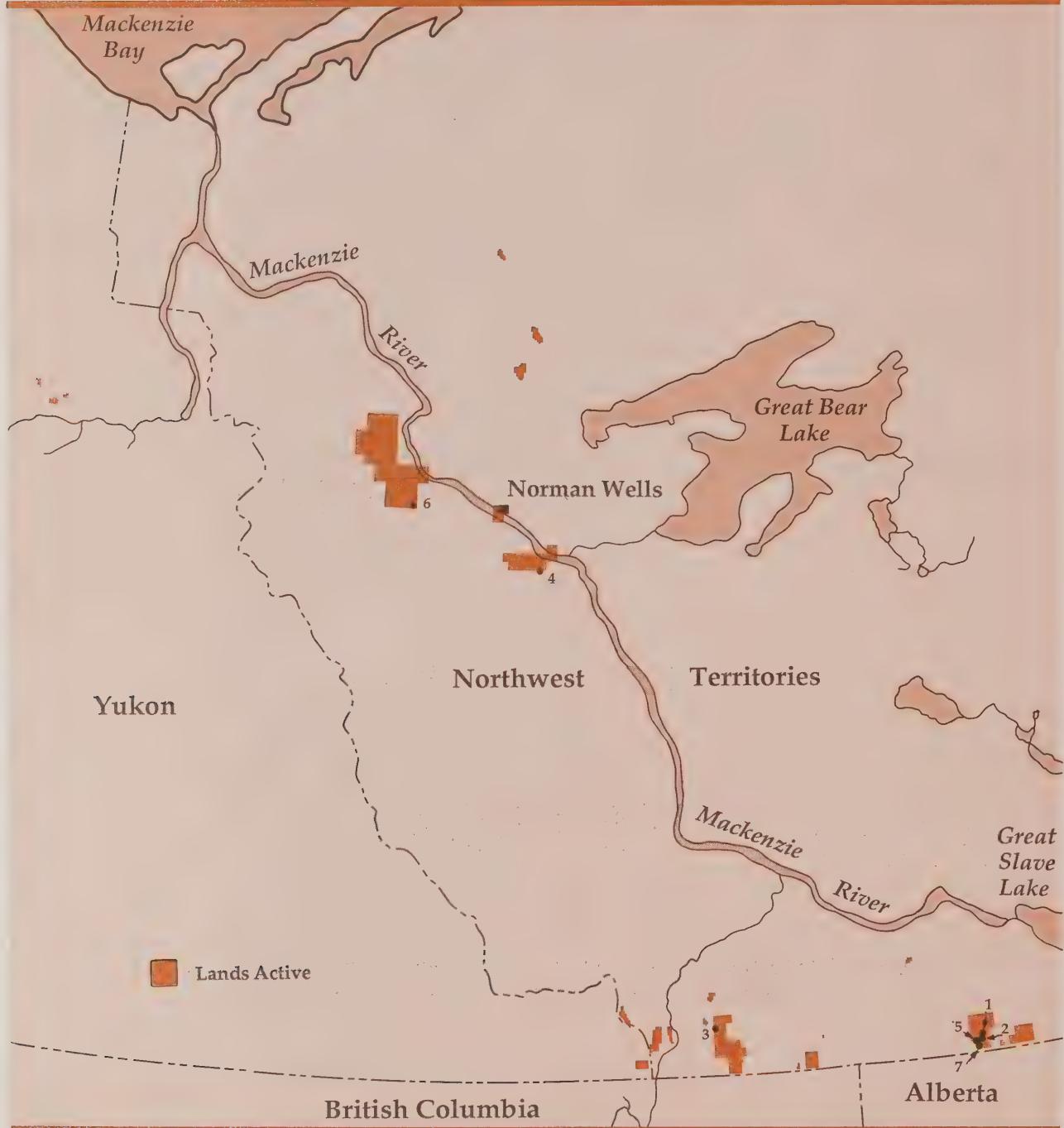
** As reported in previous years.

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	11	11	3	3	5
Rig-Months	31	33	13	6	5
Money Spent (millions of \$)					
Geophysical/Geological	60.0	11.1	2.4	8.7	12.6
Exploratory/Delineation Drilling	69.3	54.1	4.4	6.3	11.5
Development Drilling	35.2	14.3	27.0	5.3	—
Production Facilities	23.5	5.6	30.5	5.3	—
Total Money Spent (millions of \$)	188.0	85.1	64.3	25.6	24.1

LAND STATUS	1985	1986	1987	1988	1989
Licences (ELs/SDLs) Concluded	0	0	24	18	0
Total ELs/SDLs Active	34	30	29	30	25
Lands Negotiated into ELs/SDLs (millions of ha)	0	0	4.5	0.08	0
Lands Relinquished/Surrendered (millions of ha)	3.1	3.3	4.7	0.9	0.38
Lands Active (millions of ha)	9.2	5.7	2.3	1.2	0.9

Mainland Territories

Statistical Summary



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Paramount et al. Cameron Hills I-10	60°09'39"N 117°30'04"W	<i>Arnco</i> #1 <i>Cactus</i> 21 <i>Poncho</i> #103 <i>Roll'n Rig</i> 31	85-02-19 85-04-02 86-01-31 86-03-07 86-03-16 86-03-31 89-02-05 89-02-22	Plugged & suspended	1 563
2.	Paramount et al. Cameron B-08	60°07'07"N 117°30'46"W	<i>Sierra</i> 2 <i>Roll'n Rig</i> 31 *	89-01-19 89-02-09 89-02-23 89-03-09 89-03-09 89-03-28	Plugged & suspended	1 560
3.	Shell et al. Arrowhead B-41	60°30'08"N 122°53'17"W	<i>Atco</i> 48	89-01-22 89-03-24	Plugged & suspended, gas discovery	3 080
4.	Conoco et al. North Little Bear O-51	64°40'57"N 125°54'55"W	<i>Atco/Egutak</i> 76	89-02-06 89-02-26	Plugged & abandoned	2 190
5.	Paramount et al. Cameron L-47	60°06'32"N 117°39'12"W	<i>Sierra</i> 2 <i>Roll'n Rig</i> 31 *	89-02-11 89-03-06 89-03-12 89-03-21 89-03-29 89-04-02	Plugged & suspended	1 565
6.	Chevron et al. Mountain River O-18	65°37'58"N 129°02'29"W	<i>Shehtah</i> 1	89-11-30	Drilling	1 079
7.	Paramount et al. Cameron L-44	60°03'32"N 117°13'03"W	<i>Sierra</i> 2	89-12-29	Drilling	391

* Tested through separator.

In 1989 abandonment operations were completed for the following wells:

Briggs N.E. Tathlina Lake No. 1 C-27
Horn River Decalta et al. Trout D-66
Columbia et al. Kotaneelee Y.T. I-48

Mackenzie Delta and Beaufort Sea

Statistical Summary



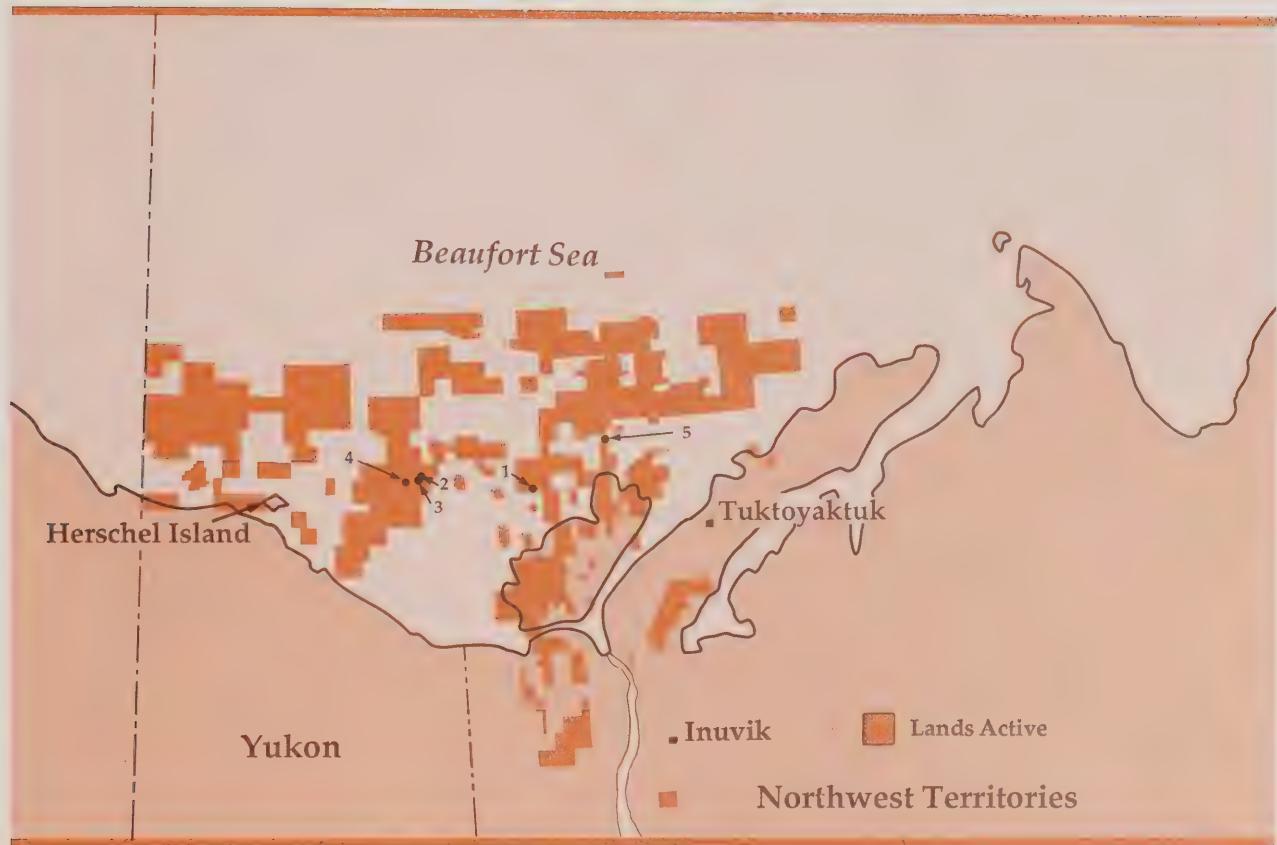
ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded Exploratory/Delineation	19	17	3	3	5
Wells Terminated* Exploratory/Delineation	16	24	3	4	4
Metres Drilled Exploratory/Delineation	48 370	48 016	8 344	13 438	11 273
Geophysical Programs Run Reflection Seismic km	8 4 700	5 4 756	1 139	7 11 475**	11 19 483**

RESOURCES STATUS	1985	1986	1987	1988	1989*
Discovered Resources**					
Gas (billions of m³)	284.2	292.8	302.1	308.5	322.7
Oil (millions of m³)	183.1	193.2	253.2	253.2	256.4
Oil Production, Amauligak (thousands of m³)	—	50.4	—	—	—

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	13	11	3	2	4
Rig-Months	43	43	5	10	9
Money Spent (millions of \$)					
Geophysical/Geological Exploratory/Delineation Drilling	38.4 760.5	14.6 391.5	0.2 108.6	27.6 99	36.6 196.6
Total Money Spent (millions of \$)	798.9	406.1	108.8	126.6	233.2
LAND STATUS	1985	1986	1987	1988	1989
Licences (ELs/SDLs/PLs) Concluded	0	0	11	49	7
Total ELs/SDLs/PLs Active	23	23	28	59	62
Lands Negotiated into ELs/SDLs (millions of ha)	0	0	2.1	1.4	0.2
Lands Relinquished/Surrendered (millions of ha)	1.6	3.1	1.4	2.1	1.4
Lands Active (millions of ha)	7.3	4.2	2.9	3.4	2.5

* In the Beaufort Sea, where operations are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

** Includes three-dimensional seismic equivalent.



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Esso Chevron et al. Nipterik P-32	69°41'47"N 135°22'44"W	Esso 2	89-02-21 89-04-20	Plugged & abandoned, oil and gas discovery	2 136
2.	Gulf et al. Immiugak N-05	69°44'53"N 137°01'21"W	Kulluk	89-06-01 89-06-10	Junked & abandoned	397
3.	Gulf et al. Immiugak A-06	69°45'02"N 137°00'20"W	Kulluk	89-06-18 89-07-27 89-09-01 89-09-24	Plugged & abandoned	3 800
4.	Amoco et al. Kingark J-54	69°43'44"N 137°28'15"W	Explorer 1	89-07-18 89-10-10	Plugged & abandoned	2 247
5.	Esso Chevron et al. Isserk I-15	69°54'44"N 134°17'57"W	Molikpaq	89-11-11	Testing	2 693

Arctic Islands and Eastern Arctic Offshore

Statistical Summary



ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded Exploratory/Delineation	3	2	1	0	0
Wells Terminated Exploratory/Delineation	3	2	1	0	0
Metres Drilled Exploratory/Delineation	6 185	4 940	689	0	0
Geophysical Programs Run Reflection Seismic km	0 0	0 0	0 0	0 0	0 0
RESOURCES STATUS	1985	1986	1987	1988	1989
Discovered Resources*					
Gas (billions of m³)	415.7	416.4	416.4	416.4	416.4
Oil (millions of m³)	65.7	65.7	65.7	65.7	65.7
Oil Production, Bent Horn (thousands of m³)	29.5	17.5	34.5	54.9	43.4
BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	3	2	1	0	0
Rig-Months	9	4	2	0	0
Money Spent (millions of \$)					
Geophysical/Geological	0.2	0	0	0	0
Exploratory/Delineation Drilling	48.0	34.5	8.3	0	0
Production Facilities	7.8	0.6	0.5	0	0
Total Money Spent (millions of \$)	56.0	35.1	8.8	0	0
LAND STATUS	1985	1986	1987	1988	1989
Licences (ELs/SDLs/PLs) Concluded	1	1	3	24	0
Total ELs/SDLs/PLs Active	25	21	16	30	24
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	0.7	0.9	0.3	0.4	0
Lands Relinquished/Surrendered (millions of ha)	1.4	8.9	5.9	0.6	0.17
Lands Active (millions of ha)	15.1	7.5	1.6	1.4	1.29

* As reported in previous years.



In 1989 abandonment operations were completed for the Panarctic Tenneco et al. Thor P-38 well.

Nova Scotia Offshore

(including the Gulf of St. Lawrence)
Statistical Summary



ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded Exploratory/Delineation	10	6	3	1	0
Wells Terminated Exploratory/Delineation	14	8	3	1	0
Metres Drilled Exploratory/Delineation	47 064	29 744	9 583	5 208	0
Geophysical Programs Run Reflection Seismic km	14 26 814	2 613	1 195	2 0	1 504
RESOURCES STATUS	1985	1986	1987	1988	1989*
Discovered Resources**					
Gas (billions of m³)	127.4	150.6	160.9	162.4	164.7
Condensate and Oil (millions of m³)	20.0	22.1	22.9	22.9	23.7
Oil Production, Panuke (thousands of m³)	—	—	3.7	—	—
* Includes new discoveries and revisions to previous estimates.					
** As reported in previous years.					
BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	8	5	2	1	0
Rig-Months	50	22	5	4	0
Money Spent (millions of \$)					
Geophysical/Geological	29.2	0.9	0.2	0.2	0.7
Exploratory/Delineation Drilling	452.0	176.8	35.3	31.5	0
Total Money Spent (millions of \$)	481.2	177.7	35.5	31.7	0.7
LAND STATUS	1985	1986	1987	1988	1989
Exploration Agreements (EAs) Concluded	2	13	3	1	3
Total EAs Active*	28	15	17	15	17
Lands Negotiated into EAs (millions of ha)	0.9	1.7	0.3	0.04	0.1
Lands Relinquished/Surrendered (millions of ha)	2.8	3.2	1.1	0.4	0.12
Lands Active* (millions of ha)	4.2	1.1	0.7	0.3	0.24

* Includes declared significant discovery areas.



Appendix

Newfoundland Offshore

(1986-1989 data verified by the Canada-Newfoundland Offshore Petroleum Board)
Statistical Summary



ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded Exploratory/Delineation	11	7	5	7	1
Wells Terminated Exploratory/Delineation	13	8	5	8	2
Metres Drilled Exploratory/Delineation	49 098	31 415	17 486	19 967	5 876
Geophysical Programs Run Reflection Seismic km	16 19 758	1 3 537	0 0	9 3 364	0 0
RESOURCES STATUS*	1985	1986	1987	1988	1989**
Discovered Resources***					
Gas (billions of m³)	152.4	146.8	146.8	146.8	148.7
Oil (millions of m³)	185.1	176.5	181.0	212.0	235.2
BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	8	6	2	2	1
Rig-Months	63	31	16	17	4
Money Spent (millions of \$)					
Geophysical/Geological Exploratory/Delineation Drilling	27.3 630.0	4.1 347.0	0 200	5.2 154.6	0 29.4
Total Money Spent (millions of \$)	657.3	351.1	200	159.8	29.4
LAND STATUS	1985	1986	1987	1988	1989
Exploration Licences (ELs/SDLs) Concluded	0	9	1	12	5
Total ELs/SDLs Active	38	27	21	19	21
Lands Negotiated into ELs/SDLs (millions of ha)	0	1.5	0.1	0.1	0.26
Lands Relinquished/Surrendered (millions of ha)	10.9	9.2	1.8	1.0	0.3
Lands Active (millions of ha)	11.9	3.4	1.7	0.8	0.76

* These figures have been generated by COGLA and may differ from those published by CNOPB.

** Includes new discoveries and revisions to previous estimates.

*** As reported in previous years.



Newfoundland Offshore

Statistical Summary

Map No.	Name of Well	Latitude, Longitude	Spudded, Drilling Unit	Reentered, Terminated	Total Status, Results	Depth (m)
1.	Texaco et al. Amethyst F-20	46°39'24"N 48°02'28"W	<i>Maersk Vinlander</i>	88-12-25 89-02-09	Plugged & abandoned	3 305
2.	Texaco et al. Springdale M-29	46°28'48"N 48°19'28"W	<i>Maersk Vinlander</i>	89-02-11 89-03-09 89-04-04 89-05-14	Plugged & abandoned, gas discovery	3 192

Glossary of Terms

Abandoned Well: Any well that has been permanently plugged.

Benefits Plan: A plan submitted by operators and approved by the minister that states the employment and procurement intentions of operators related to their exploration and development activities on frontier lands.

Call for Bids: A notice published in the Canada Gazette or other publication, whereby the minister calls for the submission of bids in relation to Crown reserve lands. Formally called a call for proposals under the Canada Oil and Gas Act.

Call for Nominations: A notice inviting interested parties to nominate tracts of lands for potential inclusion in a call for bids.

Completed Well: A well that has been drilled and equipped so that it is capable of producing oil or gas.

Cubic Metre of Gas: Equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.

Cubic Metre of Oil: Equivalent to 6.2898 American stock tank barrels.

Delineation Well: A well drilled as a follow-up to a discovery well on the same geological feature, with the purpose of determining the extent and commercial potential of the oil or gas accumulation encountered in the discovery well.

Development Plan: A plan that describes the approach and facilities that the proponent intends to use to recover hydrocarbon resources based on the proponent's interpretation of geology and reservoir characteristics of a field.

Drillstem Test: A test involving temporary completion of a well to evaluate fluid flow rates and to collect fluid samples.

Dry Hole: A well that has failed to find significant amounts of oil or gas.

Exploration Licence: A licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a Production Licence subject to compliance with other provisions of the Canada Petroleum Resources Act (formerly called an Exploration Agreement under the Canada Oil and Gas Act).

Exploration Well: A well drilled on a geological feature where no significant discovery has previously been made (synonymous with wildcat well).

Geotechnics: The field of science that deals with the physical and mechanical properties of soil and rock for engineering purposes.

Hectare (ha): 10 000 square metres (equivalent to 2.47 acres).

Hydrocarbon: A naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.

Infill Drilling: Drilling of wells between existing wells to better exploit the reservoir.

Injection Well (Injector): A well in which fluids are injected into an underground formation to increase reservoir pressure.

Landfast Ice: Sea ice that forms and remains attached to the shore.

Mobile Arctic Caisson: An annular steel caisson (better known as the *Molikpaq*), with deck dimensions of 75 m X 73 m, which is designed to be set down on an underwater berm.

Mobile Offshore Drilling Unit (MODU): Any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.

Primary Objective: The subsurface reservoir section thought to be the most likely to contain petroleum.

Reflection Seismic: The primary geophysical technique used in petroleum exploration for mapping subsurface geological features. Acoustic pulses created at the surface are reflected from layers that have different acoustic properties within the earth. The pulses are recorded at the surface for processing and interpretation.

Rights Issuance: The process of granting industry rights to Crown reserve lands subject to the Canada Petroleum Resources Act.

Second Generation Exploration Licence: CPRA provides for the issuance of exploration licences for a maximum term of four years where exploration agreements, issued under the previous legislation, were in existence on 20 December 1985. Those explorers who fulfilled their work requirements under the initial exploration agreements received "second generation" exploration licences.

Significant Discovery: A discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and suggests the existence of an accumulation that has potential for sustained production.

Sour Gas: Natural gas that contains dangerously high concentrations of hydrogen sulphide and sulphur dioxide.

Suspended Well: A well in which drilling or production operations have temporarily ceased.

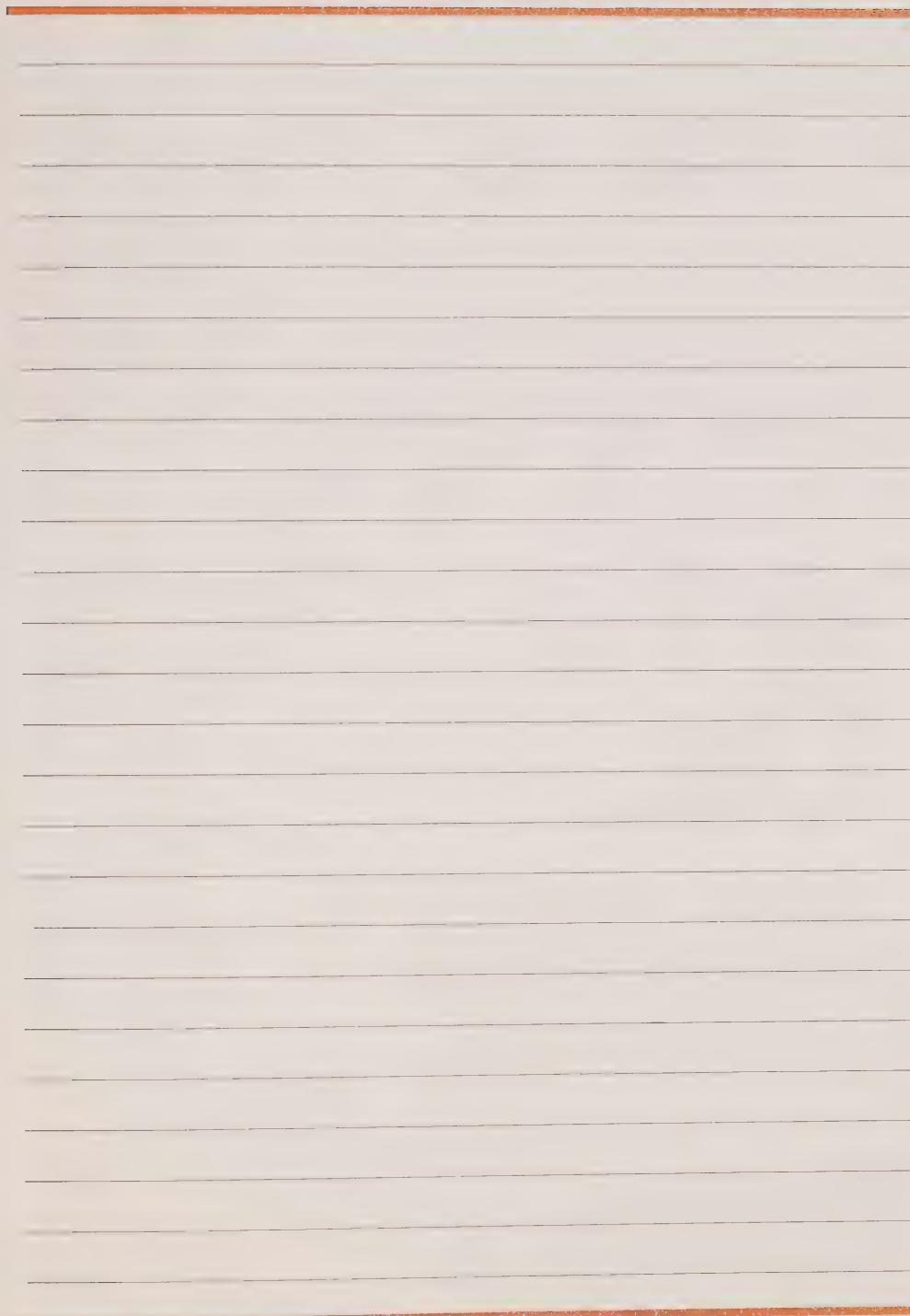
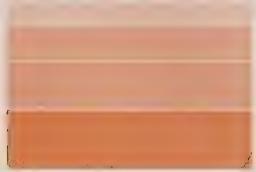
Terminated Well: A well that has reached total depth and has been abandoned, completed or suspended.

Waterflood: A method of recovery in which water is injected into a reservoir to remove additional quantities of oil from the reservoir.

COGLA Offices

Region	Mailing Address	Street Address	Telephone	Telex	Telecopier
Headquarters	15th Floor, Tower B 355 River Road Vanier, Ontario K1A 0E4	14th Floor, Tower B 355 River Road Vanier, Ontario	(613) 993-3760	053-4366	993-9897
Northwest Territories	P.O. Box 1500 Yellowknife, N.W.T. X1A 2R3	Bellanca Building 4914-50th Street 6th Floor Yellowknife, N.W.T.	(403) 920-8175	034-45570	873-8707
Western	3rd Floor 630-4th Ave. SW Calgary, Alberta T2P 0J9	Merland Building 630-4th Ave. SW 3rd Floor Calgary, Alberta	(403) 292-5631	—	—

Notes





Canada



Energy, Mines and
Resources Canada
Indian and Northern
Affairs Canada

Énergie, Mines et
Ressources Canada
Affaires indiennes
et du Nord Canada

CAI
OG
- A 56



The Canada Oil and Gas Lands Administration

Annual Report
1990

Corporate Profile

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a memorandum of understanding between the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development.

COGLA is the federal government's principal contact with the oil and gas industry in matters relating to the regulation of oil and gas activity on Canada's frontier lands. These lands include Yukon Territory, the Northwest Territories, Hudson Bay and most of the country's offshore areas. The Canada-Newfoundland Offshore Petroleum Board has operational responsibility for the Newfoundland and Labrador offshore. The Canada-Nova Scotia Offshore Petroleum Board has operational responsibility for the Nova Scotia offshore.

COGLA's prime responsibility is to regulate the exploration for, and the development and production of, oil and gas on areas of the frontier lands not under accord legislation. This responsibility is carried out in a manner that promotes safety of the worker, effective resource conservation, environmental protection, and full and fair access for Canadians to benefits and opportunities. COGLA also advises the federal energy minister on petroleum accord issues. COGLA has five branches:

- Rights Management Branch
- Engineering Branch
- Resource Evaluation Branch
- Environmental Protection Branch
- Policy Analysis and Coordination Branch

COGLA's Yellowknife office has operational responsibility for the northern offshore and onshore areas. This office regulates the geological, engineering, occupational safety and Canada benefits aspects of oil and gas exploitation activities by issuing authorizations to drill wells, by monitoring reports and other data submitted on operations, and through regular on-site inspections.

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Message from the Minister of Energy, Mines and Resources, The Honourable Jake Epp



Minister Jake Epp.

It is my pleasure to submit to Parliament the ninth annual report of the Canada Oil and Gas Lands Administration (COGLA).

1990 was a watershed year for the development of Canada's frontier hydrocarbon reserves. After years of planning and discussions by governments and industry, decisions were taken to proceed with the Hibernia and Cohasset-Panuke oil projects on the East Coast.

The joint management and revenue-sharing arrangements established in the second half of the 1980s by the federal and provincial governments provided the firm foundation upon which these decisions could be taken. This accomplishment should not be overlooked, for without the Atlantic and Nova Scotia accords and the joint management boards established under the accords, it would not have been possible to move ahead with these projects.

Hibernia and Cohasset-Panuke will have a significant impact on the development and growth of the Canadian offshore industry. They are only the first steps toward the development of the new skills, expertise and technologies required to meet the future challenges of frontier oil and gas development. These projects will place Canadians at the leading edge of offshore technologies, ready to compete for other opportunities at home and in foreign markets. With a modern infrastructure and work force in place, the stage will be set for other offshore projects, such as Terra Nova, Whiterose and Venture.

All environmental assessments for the Hibernia and Cohasset-Panuke development projects have been completed by the Government of

Canada under the Environmental Assessment Review Process (EARP) guidelines order. The government is satisfied that these projects can proceed based on the environmental conditions established by the offshore petroleum boards.

To have seen these achievements come to fruition in such a short period of time is clear testimony to the energy and dedication that COGLA employees have consistently demonstrated during the past several years. As the government begins to implement its decision to reintegrate COGLA's operations into its parent departments and the National Energy Board, I am confident that COGLA employees will continue to perform the vital functions of managing Canada's interests in its frontier regions with the same high standards of commitment and professionalism.

The 1990s hold great promise for a new and challenging period in the history of frontier oil and gas development in Canada. The work to bring Canada's frontier petroleum resources to market in significant amounts is now under way. I am confident that Canadians will rise to the challenges ahead as they work together to make frontier production a reality.

A handwritten signature in blue ink, appearing to read "Jake Epp".

Message from the Minister of Indian Affairs and Northern Development, The Honourable Tom Siddon



Minister Tom Siddon.

I am pleased to join my colleague, the Honourable Jake Epp, Minister of Energy, Mines and Resources, in tabling before Parliament the ninth annual report of the Canada Oil and Gas Lands Administration (COGLA).

As many of you are aware, steps are being taken to wind up COGLA. Responsibility for the regulation of drilling and production operations in the North, the administration of oil and gas rights and other policy-related matters previously handled by COGLA will be moved to the National Energy Board, Indian Affairs and Northern Development, and Energy, Mines and Resources.

I would like to take this opportunity to congratulate COGLA employees on their hard work and dedication. The past decade has been an active and challenging period for frontier exploration and COGLA has made a significant contribution to oil and gas regulation during that time. Their contribution has led to the changes that are now being put in place.

This action does not alter the commitment of the Government of Canada to the Frontier Energy Policy and to the Atlantic and Nova Scotia accords. Similarly, the government remains committed to the *Northern Political and Economic Framework* and the northern accord agreements in principle which were signed with each of the territorial governments in September 1988. The restructuring of oil and gas functions will support these objectives.

Reviewing the events of the past year, a number of issues come to mind. My government's commitment to a cooperative and regular rights issuance process was demonstrated in March when three exploration licences were issued to industry for lands in the central Beaufort Sea. This rights issuance completed the call for bids issued in 1989 following consultations with territorial governments and the Inuvialuit. After similar consultations this year, a call for nominations of lands in the western Beaufort Sea was announced in April. Although no

nominations were received from industry, calls will continue to be held on a regular basis.

Concerns about oil and gas exploration activities were raised during the Environmental Impact Review Board (EIRB) public hearings in June 1990, on a proposed drilling program in the Beaufort Sea. In light of the wide-ranging observations contained in the EIRB's report, I asked Robert Hornal to act as chairperson of the Beaufort Sea Steering Committee to look at the concerns highlighted during the board's hearings. The government's support for the work of the EIRB and of the steering committee is another reflection of the commitment to ensuring that oil and gas activities are conducted in a manner that is safe and sensitive to the environment. I requested that the Steering Committee provide me with its finding in early 1991. These findings will provide a valuable contribution to the organizational reform now under way.

This has been a significant year for all concerned with drilling operations in the Beaufort Sea and other northern areas. I look forward to working with all stakeholders in bringing about the development of our northern oil and gas resources.

Let me once again extend my thanks and gratitude to all the employees of the Canada Oil and Gas Lands Administration.

Canada's Frontier Lands



Area under the responsibility of the Minister of Energy, Mines and Resources

Area under the responsibility of the Minister of Indian Affairs and Northern Development

A Statement from COGLA's Administrator, Maurice Taschereau



Maurice Taschereau

For the second year in a row, frontier oil and gas exploration activity was focused in the northern region. Of the 15 wells terminated on the frontier lands, 14 were in the North, with 12 wells on the Mainland Territories and 2 in the Mackenzie Delta-Beaufort Sea area. On the East Coast, one well was drilled offshore Newfoundland near the Terra Nova oil discovery. Twenty-four geophysical and geological programs were conducted on the frontier lands during 1990, with an increase of activity in the East Coast offshore and a substantial decrease of activity in the North compared with 1989.

In March, three exploration licences were awarded as a result of a call for bids in the central Beaufort Sea. The licences are the first new exploration rights issued in the Beaufort Sea in more than two decades. A call for nominations for exploration rights in the western part of the Beaufort Sea was issued in April but did not result in any lands being nominated by industry.

COGLA continues to ensure that oil and gas exploration and development activities on Canada's frontier lands are carried out in an environmentally safe and sound manner. We conducted four major interdepartmental environmental reviews under the federal Environmental Assessment and Review Process (EARP) guidelines on proposed projects on the East Coast. Three of them were related to the Hibernia project, and the fourth was a review of the development plan application for the Cohasset-Panuke project. Based on this work, COGLA recommended to the Minister of Energy, Mines and Resources that the projects proceed.

An extensive technical review and EARP screening of the proposed Gulf Canada Resources Ltd. *Kulluk* drilling program application (DPA) for 1990-92 was nearing completion at year-end. As part of our review of Gulf's DPA, we received in June the Environmental Impact Review Board (EIRB) decision report on the Gulf application. EIRB recommended that we not approve the program because of concerns about industry and government's ability to respond to an oil spill from a blowout in the Beaufort Sea. A special steering committee has been examining the issues raised by EIRB and will be reporting to the Minister of Indian Affairs and Northern Development in 1991.

Through the year, we continued our consultations with the accord provinces, territorial governments, the offshore petroleum boards and industry on various regulatory initiatives. As a result, the Canada Oil and Gas Production and Conservation Regulations were promulgated in November. These regulations cover procedures and approvals for the

orderly and efficient development and production of hydrocarbon resources on the frontier lands. Similar regulations were drafted for the Newfoundland and Nova Scotia offshore regions. The Newfoundland Offshore Petroleum Drilling Regulations were published in *The Canada Gazette, Part I*, and are expected to be promulgated in 1991. The Nova Scotia version of these regulations was also drafted during the year.

Dialogue with territorial governments, native groups and industry is an integral part of the regulatory process. In November, COGLA and the Beaufort Sea Oil Spill Cooperative sponsored a workshop in Inuvik on oil spill cleanup and related matters as a means of enhancing contingency planning awareness in the North. Meetings to formalize community representation in the contingency planning and response team structure will be convened in 1991.

Following a recommendation to oil and gas operators in COGLA's 1989 report on the Immiugak N-05 shallow gas incident, we organized and chaired a workshop in Calgary on shallow drilling hazards in the Beaufort Sea-Mackenzie Delta region. The workshop reviewed and assessed methods and procedures for predicting and safely drilling through shallow gas, permafrost and gas hydrates.

It would not be possible to carry out our regulatory responsibilities without a team of dedicated and competent individuals. I would like to take this opportunity to thank everyone within the organization for the excellent work they accomplished over the past decade.

A handwritten signature in black ink, appearing to read "Maurice Taschereau".

Federal-Provincial-Territorial Management of the Frontier Lands

Offshore Accords

The federal government signed offshore accords with the Government of Newfoundland and Labrador in 1985 and the Government of Nova Scotia in 1986. Under these accords, the provinces have an equal say with the Government of Canada in the legislation and regulation of offshore petroleum activities.

To ensure a consistent regulatory regime throughout the frontier lands, the federal and provincial accord implementation acts incorporate provisions of the *Canada Petroleum Resources Act* and the *Oil and Gas Production and Conservation Act*.

Independent offshore petroleum boards were established to manage an offshore area on behalf of Canada and the province. The Canada-Newfoundland and the Nova Scotia Offshore Petroleum boards are under the authority of the federal and provincial energy ministers, who review fundamental decisions of the boards.

COGLA's role in implementing the accords is to facilitate the transfer of responsibilities to the boards and to provide advice and coordination on behalf of the federal energy minister.

Newfoundland and Labrador

In March Mobil Oil Canada Properties, on behalf of the Hibernia consortium, submitted its Hibernia Development Plan Update to the Canada-Newfoundland Offshore Petroleum Board (CNOPB). The

update outlines a redesign of the Hibernia platform topside facilities. The board granted approval for the new design on August 15, 1990.

Throughout 1990, the Government of Canada, the Government of Newfoundland and Labrador and the Hibernia consortium negotiated intensively to finalize agreements for the Hibernia project. These negotiations culminated in an announcement on September 14, 1990, that an agreement had been reached between all parties for an immediate start to the Hibernia project. The *Hibernia Development Project Act* (Bill C-44) was proclaimed in November, and subsequently all agreements, including those on royalties, financing, industrial benefits and related matters, were signed.

In 1990 a memorandum of understanding (MOU) was signed, which sets out roles and responsibilities of CNOPB, and of government departments and agencies for industrial and employment benefits matters relating to the design and construction of offshore projects.

Nova Scotia

The *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* was proclaimed December 22, 1989. Following proclamation of the provincial legislation on January 6, 1990, the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) was established and Fred V. Weir was appointed as chairman of the board.

LASMO Nova Scotia Limited and its partner, Nova Scotia Resources (Ventures) Limited submitted a development plan and a Canada-Nova Scotia Benefits Plan for the Cohasset-Panuke oil project to CNSOPB for approval. The board approved these plans, with conditions, in August and

received the concurrence of the federal Minister of Energy, Mines and Resources and the provincial Minister of Mines and Energy in September. Initial production is projected to begin in 1992.

In July 1990, COGLA and CNSOPB signed an MOU on the curation of well materials and reports. At year-end, arrangements were being finalized to move the curation and laboratory facility to a new location in Dartmouth.

British Columbia

The federal and provincial governments continued to follow up on various accepted recommendations of the *West Coast Offshore Exploration Environmental Assessment Panel Report*. Federal and provincial officials also held discussions on a possible offshore petroleum resources accord. At year-end, the prohibitions on offshore petroleum exploration activity were still in effect.

Northwest Territories and Yukon

During 1990 the governments of the Northwest Territories and Yukon tabled proposals with the federal government for possible northern accords. COGLA provided technical assistance to the Department of Energy, Mines and Resources and the Department of Indian Affairs and Northern Development to help prepare the federal government's proposal. In the spirit of the 1988 agreements in principle on a northern accord between the Government of Canada and the territorial governments, COGLA consulted with officials of both territorial governments on its regulatory decisions in the North. COGLA also provided advice and information on regulation and management of oil and gas activities.

Rights Management

Northwest Territories and Yukon

In March 1990 COGLA awarded three exploration licences (ELs) that resulted from a call for bids announced in late 1989. The three licences comprise about 110 000 ha in the central Beaufort Sea. Work expenditure bids for the three parcels totaled \$5.2 million. One well must be drilled on each licence during the initial term for a second term to be granted. These licences, developed in cooperation with the two territorial governments, are the first new exploration rights issued in the Beaufort Sea in more than 20 years.

In April 1990 the Minister of Indian Affairs and Northern Development announced the call for nominations No. 2-1990 for lands in the western Beaufort Sea. This call, also developed with the two territorial governments, closed September 28, 1990. Despite earlier indications that industry was interested, no nominations were received.

In 1990 COGLA continued to consult industry, accord provinces, territorial governments and offshore boards on developing regulations under the *Canada Petroleum Resources Act* for royalties, surveys, Canadian ownership, and related guidelines, forms and procedures. COGLA also began preliminary assessments of proposed call for nomination areas elsewhere in the North.

Under the authority of the ministers of Indian Affairs and Northern Development and Energy, Mines and Resources, COGLA issues, administers and registers licences that grant oil and gas exploration and production rights in Canada's North and in offshore frontier areas that are not under the jurisdiction of a regional board. COGLA also administers federally owned petroleum and mineral rights in the provinces, under the authority of the Minister of Energy, Mines and Resources.

Nova Scotia Offshore

The Canada–Nova Scotia Offshore Petroleum Board (CNSOPB) issued a call for bids in February 1990, for one parcel south of the Cohasset oil field. In early July the board announced the winning bid, comprising a work expenditure of \$2.6 million. The successful bidder was awarded exploration licence EL-2100. The licence is for a six-year term consisting of two consecutive three-year periods. To be granted tenure during the second period, the holders must begin drilling a well before the end of the first period.

CNSOPB administered rights held under 5 ELs and 30 significant discovery licences (SDLs).

Newfoundland Offshore

In November the Canada–Newfoundland Offshore Petroleum Board (CNOPB) announced the winning bids in response to a call for bids issued in July for eight parcels. Seven parcels are off the west coast of Newfoundland. These exploration licences, which will be issued in 1991, will each have a nine-year term. The total minimum work expenditure for the seven parcels is more than \$5.7 million. The eighth parcel, which has a work expenditure commitment of more than \$5 million, is located southwest of the Terra Nova field. It has a seven-year term and requires a well in the initial four-year period. In all eight licences a well must be drilled in the first period to obtain tenure for the second period.

During the year, CNOPB issued 34 new SDLs and one production licence, and administered rights under 9 ELs, 43 SDLs and one production licence.

**FRONTIER LAND HOLDINGS
AT YEAR-END, 1986-1990**

	1986	1987	1988	1989	1990
Number of Licences Active*	118	112	153	149	221
Lands Negotiated into Licences (millions of ha)	4.1	7.3	2.31	0.56	0.35
Lands Relinquished or Surrendered (millions of ha)	39.2	15.1	16.5	2.37	1.42
Lands Active (millions of ha)	33.5	20.6	7.1	5.69	4.6

* Includes exploration licences, significant discovery licences and production licences.

LAND STATUS AT YEAR-END, 1990

	Active Licences*	Lands Relinquished or Surrendered	Lands Negotiated into Licences	Lands Active	Pending Lands**
		(millions of ha)	(millions of ha)	(millions of ha)	(millions of ha)
Mainland Territories	45	0.4	0	0.6	1.1
Mackenzie Delta and Beaufort Sea	64	0.7	0.1	1.9	0
Arctic Islands and Eastern Arctic Offshore	23	0	0	1.29	2.4
Hudson Bay	0	0	0	0	1.4
Newfoundland Offshore	53	0.19	0.12	0.57	1.5
Nova Scotia Offshore (Includes Gulf of St. Lawrence)	36	0.13	0.13	0.24	3.4
West Coast	0	0	0	0	8.7
Total	221	1.42	0.35	4.6	18.5

* Includes exploration licences, significant discovery licences and production licences.

** 'Pending' includes areas where exploration activity has been suspended, for example: West Coast, Baffin Bay, Georges Bank, St. Pierre and Miquelon.

LICENCES CONCLUDED IN 1990

Operating Company	License	Number of Licences*	Area (thousands of ha)	Location	Term (years)
Esso	EL 355/356	2	47.2	Beaufort Sea	8
Amoco	EL 357	1	63.6	Beaufort Sea	8
Paramount	PL 3	1	0.08	Mainland Territories	25
Mobil	SDL 1001/1002/ 1003/1005/ 1006	5	19.4	CNOPB	—
Petro-Canada	SDL 1004/1007/ 1009/1010/ 1032/1033	6	18.8	CNOPB	—
Husky	SDL 1008/1011/ 1017-1031/ 1034	18	55.4	CNOPB	—
Esso	SDL 1012-1016	5	6.0	CNOPB	—
Mobil	PL 1001	1	22.2	CNOPB	25
LASMO	EL 2100	1	24.9	CNSOPB	6
Shell	SDL 2120 A,B/ 2121/ 2276 A,B/ 2277/2298/ 2299 A	8	40.2	CNSOPB	—
Mobil	SDL 2254/ 2255 A-E 2255 J-N 2283 A-C	14	52.6	CNSOPB	—
Petro-Canada	SDL 2259	1	4.8	CNSOPB	—
Husky	SDL 2269/2286	2	4.8	CNSOPB	—
LASMO	SDL 2255 F-H/ 2299 B/2300	5	6.3	CNSOPB	—

* Includes exploration licences, significant discovery licences and production licences.

Exploration Activity

The North

In 1990, 14 of the 15 terminated wells on the frontier lands were in the North.

Mainland Territories

A total of 12 exploratory wells were terminated in 1990. In the Fort Good Hope area, Chevron Canada Resources Limited drilled four exploratory wells: Hume River I-66, N-10 and I-20, and Mountain River O-18. All wells were drilled to total depth, evaluated, plugged and abandoned.

In the Cameron Hills area, Paramount Resources Ltd. drilled five wells to total depth, one well was spudded and suspended for further drilling in 1991, and two wells drilled in previous years were reentered for further testing. Four of the five terminated wells were successful gas discoveries: Cameron A-68, J-37 and N-28, and Swede A-73. Paramount et al. Cameron L-44 was plugged and suspended for possible use as a water

disposal well, and Paramount et al. Cameron B-25 was spudded at the end of the season and suspended because of spring breakup. It will be reentered next year and drilled to total depth. Paramount also reentered two wells for further testing: Cameron C-50, a 1986 gas discovery, and Cameron et al. L-47, a 1989 oil discovery. The other well in the area, Petro-Canada Swede E-02, was drilled to a depth of 1527 m and plugged and abandoned.

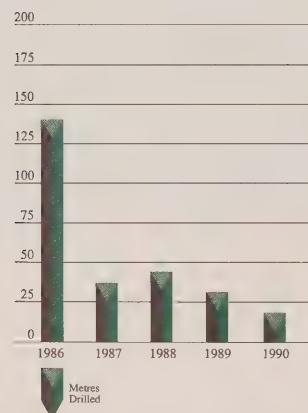
Two other wells in the southern Northwest Territories, Shell et al. Celibeta B-12 and PCI Island Lake N-45, were drilled to total depth, plugged and abandoned.

Geophysical activity decreased in 1990; only one seismic program and one gravity program were conducted. In the Fort Good Hope area, Amoco Canada Petroleum Company shot 181 km of seismic, and in the northwest Yukon, next to the U.S. border, Arco Alaska undertook a small

In 1990, 15 wells were terminated on frontier lands. Exploration highlights included two significant oil and gas discoveries in the Mackenzie Delta-Beaufort Sea, and four new significant gas discoveries in the Cameron Hills area of the southern Northwest Territories.

Geophysical activity in 1990 was comparable to 1989 with an increase in activity in both the Newfoundland and Nova Scotia offshore areas. The Mainland Territories showed a decrease in activity.

Exploratory and Delineation Drilling on Frontier Lands 1986-1990 (thousands of m)



The Molikpaq at the Isserk I-15 well location in the Beaufort Sea.
Courtesy, Esso Resources Canada Limited.



gravity program. Four geological programs were undertaken. Chevron carried out two programs in the Fort Good Hope area; Arco ran one program in the northern Yukon, next to the U.S. border; and Amoco carried out one program in the Fort Simpson area.

Mackenzie Delta-Beaufort Sea

Two exploratory wells were drilled in 1990, one in the Beaufort Sea and one onshore in the Mackenzie Delta. Esso Chevron et al. Isserk I-15, in the central Beaufort Sea, was drilled from the *Molikpaq* mobile arctic caisson to a depth of 2693 m and tested oil and gas from several different zones. Onshore in the Mackenzie Delta, Shell Unipkat N-12 was drilled to a total depth of 1614 m and tested oil and gas from several zones.

Geophysical activity decreased substantially in this area, with only six programs conducted, including two site-specific surveys. Esso Resources Canada Limited completed two small reflection seismic surveys onshore Mackenzie Delta, and Geophysical Services Incorporated and Amoco each completed a marine seismic survey in the Beaufort Sea. Gulf Canada Resources Limited and BP Resources Canada Limited conducted site-specific surveys in the Beaufort Sea.

Arctic Islands and Eastern Arctic

No drilling took place in 1990. However, BP conducted a small geochemical survey in Baffin Bay.

East Coast Offshore

Geophysical activity increased noticeably in 1990, with 11 programs conducted. Drilling activity declined on the East Coast offshore, as only one exploratory well was drilled.

Newfoundland Offshore

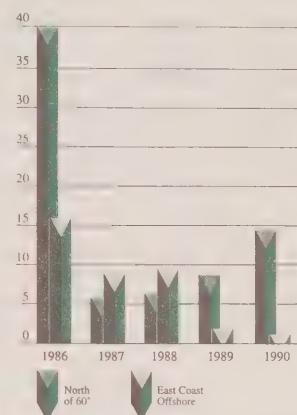
In 1990 four seismic programs were completed in the Jeanne d'Arc basin, totaling 5531 km. Shell Canada Limited and Petro-Canada Inc. each conducted a conventional two-dimensional seismic program, and Esso conducted a three-dimensional seismic program. Petro-Canada also carried out a site-specific survey. A small seismic program was also conducted on the western side of Newfoundland. BP conducted an airborne magnetometer survey and a site-specific survey.

The Petro-Canada et al. Kings Cove A-26 well was drilled southwest of the Terra Nova oil discovery using the *Sedco 710*. It was plugged and abandoned after reaching a total depth of 3092 m.

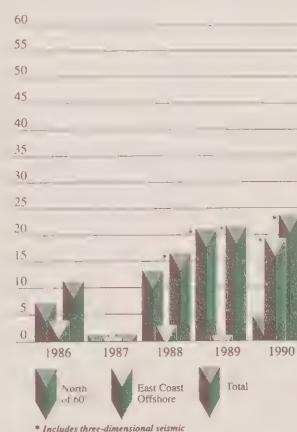
Nova Scotia Offshore

In 1990 three reflection seismic programs totaling 2731 km were run in the Sable Island area: two by LASMO and one by Mobil Oil Canada Ltd. In addition, LASMO conducted a site-specific survey near the Cohasset oil discovery. No wells were drilled in 1990.

**Number of Wells Terminated
1986-1990**



**Reflection Seismic Shot on Frontier Lands
1986-1990
(thousands of km)**



Resource Evaluation Activities

Evaluation of Hydrocarbon Potential

In 1990 COGLA worked with the Institute of Sedimentary and Petroleum Geology on two regional assessments of hydrocarbon potential: the part of the Western Canada Gas Assessment that extends into the Northwest Territories and Yukon to 62°N, and an assessment of the oil and gas potential of the Mackenzie corridor. Evaluation studies continued in the Beaufort Sea, contributing to the technical definition of the western Beaufort Sea call for nomination area.

As part of its contribution to land use planning in the North, COGLA reviewed the implications for exploration in the Mackenzie Delta-Beaufort Sea draft land use plan. COGLA also provided maps and supporting technical data to the Denendeh Regional Land Use Planning Commission for the Dene-Métis settlement area, and for the Keewatin regional land use plan in the Hudson Bay area. Evaluation work is also under way in the Old Crow flats and the Peel plateau areas of Yukon. The latter will contribute to the national park establishment process by Parks Canada and to the north Yukon regional land use plan.

Research

In 1989 COGLA awarded two contracts for research on organic geochemistry and biostratigraphy of samples from wells drilled with oil-based mud. The reports will be published in 1991.

As a member of the Pollution Prevention and Safety Panel for the *Ocean Drilling Program*, COGLA reviewed seismic data on proposed drilling locations throughout the world. COGLA also assessed potential drilling hazards and hydrocarbon accumulations at these locations.

Determination of Significant Discovery Areas

During 1990, a total of nine significant discovery areas (SDAs) were determined, including revisions to three previously declared SDAs.

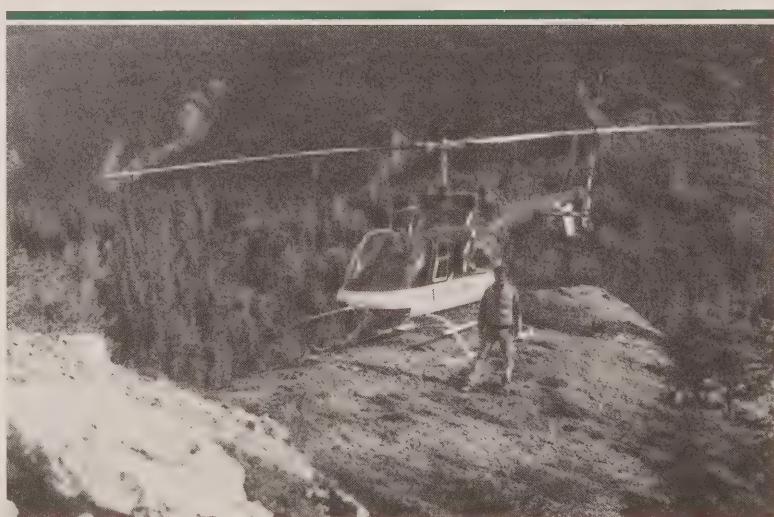
In the southern Territories, four new SDAs were determined and three existing SDAs were enlarged based on the results of recent drilling in the Cameron Hills area by Paramount Resources Ltd. and Petro-Canada Inc. An SDA was determined for the Northcor et al. F-25A well near Fort Liard, NWT. In the Mackenzie Delta, a new SDA was determined for the Shell Unipak N-12 discovery well.

Oil and Gas Committee

The Oil and Gas Committee is a quasi-judicial body that hears appeals and holds inquiries on technical matters relating to the *Oil and Gas Production and Conservation Act*. The committee also advises the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development on issues related to the *Canada Petroleum Resources Act*.

In 1990 the committee heard the first appeal on a recommended significant discovery declaration for the Esso et al. Minuk I-53 well in the Beaufort Sea.

An earlier appeal with respect to a proposed SDA for the Northcor et al. Liard F-25A discovery well, near Fort Liard, was withdrawn prior to being considered by the committee.



COGLA geologist in the field near Fort Simpson, NWT. Courtesy, T. Bird.

Conservation and Development

COGLA regulates the development and production of oil and gas in areas of the frontier lands not under accord legislation and ensures effective conservation of these valuable, nonrenewable resources.

Mainland Territories

Norman Wells

The performance of the waterflood project improved again over last year with increases in oil rates and reservoir pressure coupled with a decrease in the gas-oil ratio. Oil production in 1990 totaled 1.841 million m³, an increase from 1.789 million m³ in 1989. The daily average oil production rate increased to 5042 m³ per day with the peak production being 166 843 m³ in July. At year-end, cumulative oil production from the field was 13.99 million m³. Gas production again decreased from the previous year, with 126 million m³ produced compared with 129 million m³ in 1989.

In October 1990 a new inlet separator and pump were installed at Norman Wells. The new inlet separators increased the plant's capacity to handle slugging. This occurs in pipelines that cross the Mackenzie River. The new pump raised the plant's total fluid handling capacity.

At year-end the well count was 155 injectors and 166 producers.

Kotaneelee

The Kotaneelee gas field in the southern Yukon produced intermittently in 1979-1980. In 1983 the plant was shut down. In 1990 COGLA granted approval to Columbia Gas Development of Canada Limited for major changes to the gas plant facilities. The modifications involve installing a monodioethanolamine system to remove hydrogen sulphide from the gas used in the generators and the plant. The existing waste gas incinerator was replaced with a new vapor recovery system and flare stack, improving efficiency and gas conservation at the plant. All the direct-fired process heaters and boilers were replaced with a centralized heat-medium system. The instrumentation and control systems were also upgraded.

The operator conducted workover operations on two wells in conjunction with the reactivation of the gas processing plant. The

production zone in Columbia et al. Kotaneelee YT I-48, which had been inactive since 1979, was reperforated and new downhole equipment was installed. The Columbia et al.

Kotaneelee YT B-38 well was tested and the status of the well was changed from suspended to producing. When the plant is operating, both wells will produce gas.

Pointed Mountain

Gas production from the Pointed Mountain gas field continued to decline, with 74 million m³ produced in 1990, compared with 96 million m³ produced in 1989. This brings the total cumulative field production to 8.155 billion m³.

The Amoco Pointed Mountain G-62 well was reactivated and a gas compressor and dehydration unit, located at the well head, were installed. In August 1990 COGLA approved the operation of these new facilities.



Workover operations were carried out at the Columbia et al. Kotaneelee YT I-48 well site in the southern Yukon.

Cameron Hills

After a successful 1990 drilling season by Paramount, COGLA conducted a detailed petrophysical and hydrodynamic study to provide a preliminary estimate of reserve potential.

COGLA approved an extended flow test of the Paramount et al. L-47 well. The oil produced from the test was trucked from the Cameron Hills area to the Alberta pipeline network near Zama Lake.

Arctic Islands

Bent Horn

Panarctic Oils Ltd. made one shipment of crude from its Bent Horn oil field on Cameron Island. The *MV Arctic* left for Montreal with 24 684 m³ of oil on September 8. Total field production for 1990 was 24 037 m³, bringing the cumulative production at Bent Horn to 203 806 m³.

Nova Scotia Offshore

Cohasset-Panuke

On July 17, 1990 LASMO applied for approval of a development plan based on the preliminary development plan submitted earlier during the year for the Cohasset-Panuke offshore oil fields. The simultaneous development of both fields will entail total production of 5.5 million m³ of light crude oil. Seasonal production should begin in 1992. Production facilities that will be required include a wellhead jacket at each field connected by a subsea pipeline and a leased jack-up rig located at Cohasset. From the Cohasset production platform, the oil will be transferred to a storage tanker and then loaded on to a shuttle tanker. On August 8, 1990 the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) issued a decision report, which gave conditional approval for the development plan.

COGLA gave CNSOPB technical support on the certification process, reservoir simulation studies, geophysical and petrophysical analyses, and structural and facilities analyses.



The MV Arctic at Bent Horn.

Protection of the Worker

COGLA is responsible for ensuring, through the *Oil and Gas Production and Conservation Act* and parts of the *Canada Labour Code*, the health and safety of workers on frontier lands.

During 1990 COGLA, in consultation with representatives from the Nova Scotia and Newfoundland departments of Mines and Energy, and representatives from the Canada-Newfoundland and Canada-Nova Scotia Offshore Petroleum boards, completed work on proposals for safety amendments to the *Oil and Gas Production and Conservation Act*, and the corresponding sections of the Atlantic Accord and the Canada-Nova Scotia Accord Implementation acts. COGLA worked closely with the Department of Justice in preparing proposed amendments to the legislation. These amendments are the final statutory measures required to implement the balance of the recommendations from the Royal Commission on the *Ocean Ranger* Marine Disaster. The amendments will improve the protection of the worker by requiring that structures and equipment used by workers have certificates of fitness. Also, an installation manager must be present on the structure or facility to ensure the safety of personnel.

Drilling

In 1990 the Newfoundland Offshore Petroleum Drilling Regulations were published in Part 1 of *The Canada Gazette*. These regulations will be promulgated and published in Part 2 of *The Canada Gazette* in 1991.

The Nova Scotia Offshore Petroleum Drilling Regulations were drafted and sent to the Department of Justice for legal examination. These regulations ensure that all measures affecting the safety of human life, the prevention of pollution of the natural environment and the conservation of hydrocarbon resources meet stringent standards before approval to drill is granted by the regulator.

Guidance notes for the Canada Oil and Gas Drilling Regulations, which apply to all areas under COGLA's jurisdiction, were completed and will be published in 1991. These notes serve as guidelines and information to operators to help them meet regulatory requirements. The information required to complete an application for approval of a well is described in detail. The document sets out current COGLA policy on survival suits, personnel training, standby vessels, contingency plans, relief well arrangements, environmental concerns and financial responsibilities.

Occupational Safety and Health

The Nova Scotia Petroleum Occupational Safety and Health (OSH) Regulations were written and sent to the Department of Justice for review. These regulations and the Newfoundland version will be promulgated in 1991. The regulations set out the measures and procedures that the petroleum industry must implement to ensure a safe and healthy workplace.

In 1990 the *Non-Smoker's Health Act* and associated regulations were passed. COGLA safety officers are responsible for enforcing the act and regulations, which prohibit smoking in all workplaces and accommodation areas at exploration

and development sites. Specific rooms or areas may be designated for smoking if there is adequate ventilation.

Production

After extensive consultation with industry, the offshore petroleum boards and the accord provinces, the Canada Oil and Gas Production and Conservation Regulations were promulgated in November 1990. These regulations cover procedures and approvals for the orderly and efficient development and production of oil and gas discoveries on frontier lands. Under these regulations, the Development Plan Application Guidelines will be published in 1991. The Newfoundland and Nova Scotia offshore versions of these regulations were drafted and will be sent to the Department of Justice for review in 1991.

The 1988 Piper Alpha production installation disaster in the U.K. sector of the North Sea focused international attention on procedures for dealing with oil-field emergencies, firefighting and evacuation systems. COGLA has further improved the requirements in the draft Canada Oil and Gas Installations Regulations for structural fire protection, lifesaving equipment and firefighting equipment. In addition, the section of the draft regulations on the safety analysis of proposed installations was revised. This section now ensures that when designing the layout of proposed installations, the operator considers the safety of personnel in emergencies. Industry was consulted on these regulations, which will be submitted to the Department of Justice for review in 1991.

Geophysical

The Canada Oil and Gas Geophysical Regulations were completed in 1990 and sent to the Department of Justice for review. COGLA worked with the accord provinces and the offshore petroleum boards on the version of these regulations that apply to the East Coast offshore. These regulations apply to operators who conduct geophysical operations on the frontier lands. They establish standard procedures for obtaining authorization to conduct the program, and stipulate safe working practices, measures for protecting the environment and reporting requirements.

Safety Training

COGLA and other regulatory authorities worked with industry to develop the Canadian Offshore Petroleum Industry Qualifications, Safety Training and Certification (Drilling) Standard. This details the minimum safety, marine and industrial training required for each crew member of a mobile offshore drilling unit (MODU) and a standby vessel. The document also specifies the number and type of certified personnel required on board each type of drilling unit. These training standards were published in November 1990.

Diving

COGLA and the Canadian Association of Diving Contractors conducted a study that evaluated the Defence and Civil Institute for Experimental Medicine Diving Tables and the development of diving databases. The study provides a method for evaluating and determining safety margins of various decompression tables now used in commercial diving applications.

In 1990 COGLA received numerous applications for certifying divers and diving-related personnel interested in working in the Canadian offshore. COGLA carefully reviewed these applications according to the requirements of the Canada Oil and Gas Diving Regulations. More than 50 personnel were certified during the year.

Shallow Drilling Hazards

In 1990 COGLA organized and chaired a workshop in Calgary on shallow drilling hazards in the Mackenzie Delta-Beaufort Sea. Northern operators and invited experts attended the workshop. This workshop was recommended to operators in COGLA's 1989 report on the Immiugak N-05 blowout incident. The workshop reviewed and assessed methods and procedures for predicting and safely drilling through shallow gas, permafrost and gas hydrates. Participants came to some agreement on procedures and equipment

requirements for drilling through these hazardous zones. Workshop proceedings were published and sent to participants and potential explorers. Operators are encouraged to consult these proceedings when planning drilling programs in this area.

In 1990 COGLA encouraged the development of an annular control tool with northern operators. This tool minimizes the risk of a shallow blowout by immediately sealing off the annulus when gas is encountered, thereby preventing flow from reaching the unit's rig floor. A prototype has been developed and tested successfully. This tool will enhance well control at shallow depths, increasing safety for the drill crew.

Floating Vessel Blowout Control

In conjunction with other national authorities and 15 major worldwide operators, COGLA participated in a joint industry-government project studying blowout control from a floating vessel. The study addresses the problems of developing new technology for shallow blowout control, for relief well intervention and for controlling pollution emanating from a deep-water blowout. The project was 70 per cent completed at year-end and the final report is expected in May 1991. The report will help formulate contingency plans for floating MODUs and will identify the areas where technological development is necessary.

Lost-Time Accidents

COGLA established a hazardous occurrence report database in 1990 for employees working at exploration and development sites. This database will contain historical information on accidents on the frontier lands. The



Workers installing ice load measurement sensors at the Isserk I-15 well site in the Beaufort Sea.
Courtesy, Esso Resources Canada Limited.

database will help to determine which OSH regulations need changes.

In 1990, no lost-time accidents (LTAs) occurred at drill sites on the frontier lands, resulting in a significant reduction in the incidence rate of LTAs from the 18.6 per million person-hours worked recorded last year. However, a total of four production and workover related LTAs were reported to COGLA safety inspectors. There were no fatalities associated with oil and gas activities on the frontier lands during the year.

Inspections

COGLA officials inspect exploration and production sites to ensure that operations are conducted according to approved program and regulatory requirements. In 1990 a total of 21 drilling, 3 production facilities and 2 geophysical inspections were conducted.

Research and Development

Research and development is an integral part of COGLA's activities. Environmental conditions on frontier lands require that new technologies be developed, assessed and implemented or that established technologies be adapted to these unique conditions.

Under the Interdepartmental Panel on Energy Research and Development (PERD), COGLA chairs the Task 6.2 Marine Engineering Committee, and serves on the geoscientific, offshore geotechnics, materials, transportation and environment committees. Through these committees, COGLA promotes studies in personnel safety, environmental protection, structures engineering, ice-structure interaction and environmental design criteria. The major projects sponsored by PERD and managed by COGLA are described below.

Evacuation Technology

During the year, various innovations in evacuation technology were reviewed to assess their applicability to operating conditions on Canada's East Coast. To give rig workers as many evacuation options as possible, the report recommended that research be conducted on improving the facilities for dry evacuation of personnel from the drilling platform to the standby vessel. As a result, a follow-up project was initiated to design a way of transferring personnel. The design includes a constant-tension line between the rig and the standby vessel; personnel can use various available appliances to evacuate down the line.

Protection of Submarine Pipelines from Ice Scour

The safe design and operation of pipelines in the Arctic and Newfoundland offshore requires an understanding of how ice scouring can threaten the integrity of a pipeline. The results of a comprehensive study evaluating

the possible effects of ice scouring on a pipeline were presented at an international workshop entitled *Ice Scouring and the Design of Offshore Pipelines*. The workshop was cosponsored with the Centre for Cold Ocean Resources Engineering. The recommendations from the workshop are being used to determine future priorities in ice scour and pipeline design research.

Ice-Structure Interaction

COGLA chairs an advisory committee that directs ice-structure interaction research for PERD Task 6.2. Research in this area is directed to collecting ice-load field data and developing numerical processes that can be used for assessing ice-structure interaction. The 1990 field program included participating in a joint industry program at Isserk I-15 in the Beaufort Sea, to measure ice loads, rubble field stability and ice movement. The results will be used to evaluate structures in the landfast ice zone of the Beaufort Sea.



Safety inspectors routinely carry out inspections of oil and gas operations on the frontier lands.

The advisory committee is also sponsoring a major effort to develop new ice-structure interaction models. The initial phase of this project was completed and four contractors developed ice-load models. The study's objective is to better understand the interaction process and to improve methods for calculating ice loads on Arctic structures.

Polar Lows

COGLA sponsored a project to investigate the occurrence, frequency and behavior of polar lows over Canadian waters. As part of the

project, the Atmospheric Environment Service of Environment Canada gave presentations on the prediction and climatology of these rapidly

developing storms at all major forecast offices throughout Canada. These presentations sensitized forecasters to these phenomena and will help them

predict these storms. Canadian numerical weather prediction models were also prepared to improve the forecasting of these storms. A forecaster's handbook for predicting polar lows will be published at the end of the project. The ability to predict these storms will enhance the safety and efficiency of operations in the offshore.



A satellite picture of a polar low off the northeast coast of Labrador.
Courtesy, Atmospheric Environment Service.

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1990

	Person-Hours at Work Site				Lost-Time Accidents		Accident Rate	
	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel	(LTA/Millions of Person-Hours)	
Mainland Territories*	109 858	—	0	—	0	—	0	—
Mackenzie Delta and Beaufort Sea*	25 352	—	0	—	0	—	0	—
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—	—	—
Newfoundland Offshore	106 392	46 056	0	2	0	—	43.4	—
Nova Scotia Offshore	—	—	0	—	—	—	—	—
Total	241 602	46 056	0	2				

* Estimated.

Protection of the Environment

East Coast

In 1990 COGLA conducted four major environmental reviews on proposed development projects in the East Coast offshore. Three reviews were on the Hibernia development project, offshore Newfoundland, and one review was on the Cohasset-Panuke development project, offshore Nova Scotia.

Hibernia

In March 1990 Mobil Oil Canada Properties and its joint venture partners (the consortium) submitted a revised development plan, the Hibernia Development Plan Update, to the Canada-Newfoundland Offshore Petroleum Board. COGLA coordinated a federal interdepartmental environmental review of the update. In August, based on the review by COGLA and comments received from other departments, COGLA recommended to the Minister of Energy, Mines and Resources (EMR) that the project proceed, since no significant adverse environmental or social effects were identified at this stage of the project.

In late 1989, the consortium selected Bull Arm on Trinity Bay as the preferred platform construction site. Because this site had not previously been examined, COGLA coordinated an environmental screening with other federal government departments according to the federal Environmental Assessment and Review Process (EARP). In August 1990, COGLA recommended to the EMR minister that the project proceed since the potential adverse environmental and directly related social effects were deemed to be insignificant or mitigable with known technology.

Marystown Shipyard Limited (MSL) submitted a proposal to construct and operate the Cow Head Offshore Fabrication Complex as an extension to its existing oil rig servicing facility at Cow Head, Mortimer Bay. The expansion will allow MSL to bid on metal fabrication contracts associated with the Hibernia development project and other future offshore developments. Since the expansion project received federal funding from the Offshore Development Fund, EARP guidelines required that a federal environmental assessment be carried out. COGLA coordinated a federal departmental review of the project. In November, after receiving advice from other government departments, COGLA recommended to the EMR minister that the project proceed because potential adverse environmental and social effects were deemed to be insignificant.

Cohasset-Panuke

To meet EARP requirements, COGLA coordinated the federal departments' environmental review of the Cohasset-Panuke development plan project application.

Part of the review involved examining public submissions made to the Cohasset-Panuke Environmental and Socio-Economic Review Commission and the commission's report. J.R. (Pat) Ellis chaired the commission. In September COGLA recommended to the EMR minister that the project proceed because it would not have any significant effect on the environment, if the measures recommended by the commission were incorporated in the development plan.

West Coast

As a member of the Pacific Environmental Coordinating Committee, COGLA helped fund and develop a computer-based coastal resource sensitivity information system. This system has been completed and, when fully developed, will be a useful tool in identifying environmental sensitivities for offshore coastal areas.

North

Kulluk Public Review

In March 1989 Gulf Canada Resources Ltd. submitted a project description for its proposed *Kulluk* drilling program 1990-1992 to the Environmental Impact Screening Committee according to the terms of the Inuvialuit Final Agreement. The Gulf project was referred to the Environmental Impact Review Board (EIRB) for a more detailed environmental assessment and review because of concerns for contingency planning and countermeasures in the event of an oil spill.

Following public hearings in June in Inuvik, EIRB recommended to COGLA that the application be rejected. EIRB felt that neither the proponent nor the government were prepared to effectively handle an oil spill in the Beaufort Sea. EIRB also noted that it had insufficient

documentation for assessing the aggregate financial liability that would accrue if a worst-case oil well blowout occurred. The report outlined numerous other concerns related to the primary reasons for its recommendation. COGLA published its observation on the EIRB report in the publication, *Observations on the EIRB's June 29, 1990 Decision Report on Gulf Canada Resources Ltd. Proposed Kulluk Drilling Program.*

To resolve the various long-term issues raised by the application, the Minister of Indian Affairs and Northern Development established the Beaufort Sea Steering Committee. R. Hornal, a consultant familiar with northern environmental issues, chairs the committee. The steering committee members include representatives from Beaufort Sea petroleum operators, Inuvialuit and government agencies. Seven subcommittees were established to address the issues raised in the EIRB report. The steering committee was asked to prepare recommendations for the minister based on the results of the subcommittees.

Cleanup Technology Workshop

In November, COGLA, in cooperation with the Beaufort Sea Oil Spill Cooperative, sponsored an Inuvik workshop on cleanup technology as part of a long-term program to promote contingency planning awareness in the North. More than 60 participants from northern communities, government and the oil industry discussed the current state of preparedness, technical capability and

logistical problems that relate to oil spill cleanup. It is intended that during 1991, meetings will be convened to formalize community representation in the contingency planning and response team structure.

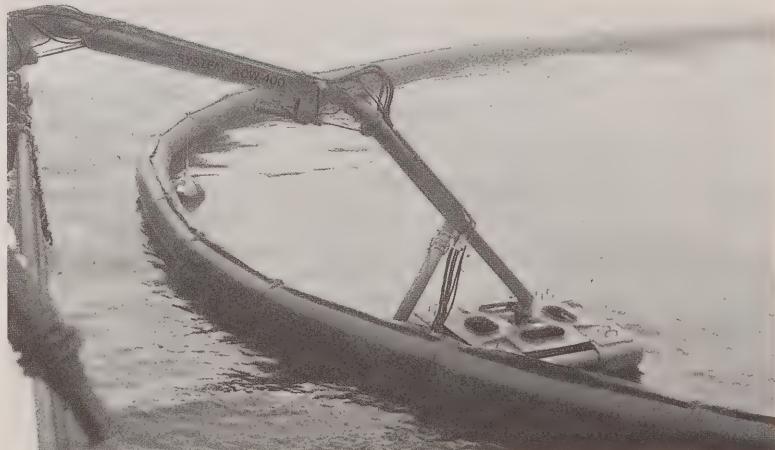
Land Use Planning

COGLA provided environmental information to the Mackenzie Delta-Beaufort Sea, Denendeh and Nunavut Regional Land Use Planning commissions. The Minister of Indian Affairs and Northern Development and the NWT Minister of Renewable Resources approved the Lancaster Sound Regional Land Use Plan in November 1990, and the responsibility for this planning region has now been

assumed by the Nunavut Planning Commission. COGLA also helped the Kluane and North Yukon Land Use Planning commissions in Yukon formulate land use plans for land users.

Environmental Studies Research Funds

COGLA continued to administer the Environmental Studies Research Funds (ESRF). These funds are special levies on the oil and gas industry that are used to conduct research studies. The studies help industry and government make environmental and social decisions on oil and gas activities on Canada's frontier lands.



Offshore oil skimmer and boom. Courtesy, S. Gill.

The 1990 program budget was almost double that of 1989 and is now more than one million dollars. ESRF is currently funding 14 studies covering topics from geoscience investigations and physical environment studies, to effects of oil on marine species and marshlands. Some studies conducted in 1990 are described below.

Repetitive Mapping of Ice Scours

These studies quantify depth and frequency of scour trenches left by icebergs and pressure ridge keels on the seafloor. This information will affect the design of structures, such as subsea pipelines and wellheads. Studies have been funded for the Grand Banks and Beaufort Sea areas.

Geoscience Issues Related to Gas Developments in the Mackenzie Delta

This study covers a range of field studies for improving the understanding of geothermal and geotechnical conditions of the delta. Field investigations emphasize geothermal and permafrost stability, active geomorphic processes and ground ice distribution. The results have a direct bearing on the design of facilities that may be used to exploit the petroleum resources of the area.

Iceberg Trajectory Modeling

This study tests an existing iceberg trajectory simulation program with operational data in a real-time environment. The information provided by the test could help develop a prediction system that could improve the iceberg management activities associated with exploration and development on the Grands Banks and Labrador offshore areas.

Mackenzie Delta-Beaufort Nearshore Overwintering Fisheries Habitat

This study investigates and develops a database of the distribution of fish species overwintering near the Mackenzie Delta. This information will be used to minimize any environmental effects of exploration and development activities on important fish species and stocks overwintering in the area.



Icebergs are frequently the subject of research to ensure the safety of offshore personnel who are working on drilling rigs.

Employment and Industrial Benefits

COGLA is responsible for promoting full and fair access for Canadians to industrial benefits and employment opportunities that may arise from oil and gas exploration, development and production activities on Canada's frontier lands.

Onshore and offshore oil and gas activities created 2464 jobs in 1990. In the North, 1571 jobs were created; all but two jobs were filled by Canadians. On the East Coast, Canadians filled 729 jobs out of a total of 893.

In 1990 foreign business groups and governments continued to express interest in the opportunities in Canada's offshore development. Many groups came to Canada to learn more about these opportunities; others formed joint ventures with Canadian companies. COGLA gave a presentation on Canada's oil and gas potential, with emphasis on East Coast developments and related business opportunities, to the Canada-Norway Offshore Working Group.

Northern Developments

In March 1990 a call for bids for parcels of lands in the central Beaufort Sea resulted in three exploration licences. The call gave the federal, NWT and Yukon governments an opportunity to work together on benefits matters, as called for in the 1988 agreements in principle on a northern accord. The territorial governments will monitor northern benefits; the federal government will monitor national benefits. With few exceptions, benefits for northern exploration programs are domestic,

since expenditures and labor are concentrated in western Canada and in the North.

East Coast Developments

COGLA officials assisted Energy, Mines and Resources in negotiating the benefits provisions of two project agreements: the Hibernia oil project offshore Newfoundland and the Cohasset-Panuke oil project offshore Nova Scotia.

Hibernia

As the first major offshore development project in Canada, Hibernia will generate significant new business opportunities for companies in Newfoundland and Labrador, and in other parts of Canada. Hibernia is one of the largest and most technologically complex petroleum projects ever undertaken by the petroleum industry. It is expected to be a major force in strengthening existing Canadian capabilities and in fostering new ones.

In the final Hibernia agreement, the Hibernia consortium estimated a Canadian content level of 55 to 60 per cent of the \$5.2 billion pre-production capital expenditures during project development, and a Canadian employment level of 66 per cent. The consortium also estimated that 85 to 90 per cent of the person-hours for total project management and for engineering design of the gravity base structure, topside and the offshore oil-loading facilities will take place in Canada. After production begins, an additional \$3.3 billion in capital

expenditures will be spent to fully develop the field. Operating phase expenditures are estimated to total \$10 billion over the projected 18-year production life of the oil field.

Cohasset-Panuke

This project involves the development of two oil fields located near Sable Island, offshore Nova Scotia, using conventional offshore technology similar to that used in the Gulf of Mexico. The Canadian content level for the Cohasset-Panuke project during the development stage is estimated to be 70 per cent of the \$160 million capital expenditures, while Canadian employment level is expected to be around 70 per cent. The forecast for Canadian content and employment levels during the production stage are estimated at 40 per cent and 85 per cent respectively.



Worker at Norman Wells, NWT.
Courtesy, Esso Resources Canada Limited.

TOTAL 1990 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total Work Force*	Canadian	Per Cent Canadian
Mainland Territories**	619	619	100
Mackenzie Delta and Beaufort Sea**	922	921	99.9
Arctic Islands and Eastern Arctic Offshore**	30	29	97
Newfoundland Offshore	747	587	79
Nova Scotia Offshore	146	142	97
Total	2 464	2 298	93

* Represents approximate number of jobs created.

** Jobs in the North are seasonal.

TOTAL 1990 PETROLEUM EXPENDITURES ON FRONTIER LANDS

	Exploration*	Development	Production** (millions of \$)	Total	Canadian	Per Cent Canadian***
Mainland Territories	29.1	—	—	29.1	27.6	95
Mackenzie Delta and Beaufort Sea	35.5	—	—	35.5	30.2	85
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—
Newfoundland Offshore	36.1	—	—	36.1	28.2	78
Nova Scotia Offshore	4.5	—	—	4.5	3.1	68
Total	105.2	—	—	105.2	89.1	85

* Includes geophysical expenditures.

** In 1990, pre-production expenditures for the Hibernia and Cohasset-Panuke development projects totaled \$58.8 million and \$18.5 million respectively.

*** Estimates.

Statistical Summary

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Frontier Lands

Statistical Summary

ACTIVITY STATUS ON FRONTIER LANDS

	1986	1987	1988	1989	1990
Licences (ELs/SDLs/PLs)					
Concluded	23	42	105	15	70
Wells Spudded	60	48	25	12	13
Metres Drilled	150 404	67 234	54 391	27 014	18 903
Wells Terminated	70	50	27	10	15
Discoveries	14	1	2	4*	6
Geophysical Programs Run	15	7	27	21	19
Reflection Seismic km	11 001	2 756	16 568	21 587	23 684
Rig-Months	133	41	37	18	16

* Includes revision to 1989 COGLA Annual Report.

FRONTIER LANDS RESOURCE INVENTORY, 1990

	OIL*		GAS	
	Discovered (millions of m ³)	Potential	Discovered (billions of m ³)	Potential
West Coast	0	50	0	270
Mainland Territories	37.7	95	35.5	312
Mackenzie Delta and Beaufort Sea	240.7	1 112	356.6	1 918
Arctic Islands and Eastern Arctic Offshore	65.7	873	416.4	3 156
Hudson Bay	0	127	0	88
Newfoundland Offshore	287.4	894	162.5	1 649
Nova Scotia Offshore	23.7	318	164.7	663
Total	655.2	3 469	1 135.7	8 056

* Includes condensate.

OIL AND GAS PRODUCTION ON FRONTIER LANDS

	1986	1987	1988	1989	1990
Oil Production (thousands of m ³)					
Norman Wells	1 411	1 531	1 728	1 789	1 841
Bent Horn	17.5	34.5	54.9	43.4	24
Amauligak	50	—	—	—	—
Panuke	—	3.7	—	—	—
Gas Production (millions of m ³)					
Pointed Mountain	205	156	154	96*	74
Norman Wells	188	163	138	129	126

* Includes revision to previous estimates.

Mainland Territories

Statistical Summary



ACTIVITY STATUS	1986	1987	1988	1989	1990
Wells Spudded					
Exploratory/Delineation	14	1	3	6	11
Development	14	35	11	—	—
Total	28	36	14	6	11
Wells Terminated*					
Exploratory/Delineation	14	2	3	4	12
Development	14	36	11	—	—
Total	28	38	14	4	12
Metres Drilled	36 289	31 132	15 778	9 865	14 197
Exploratory/Delineation	24 401	974	7 095	9 865	14 197
Development	11 888	30 158	8 683	—	—
Geophysical Programs Run	7	5	9	9	2
Reflection Seismic km	2 095	149	1 729**	1 600	181

* In the Mainland Territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be reentered in the following year for testing.

** Includes three-dimensional seismic equivalent.

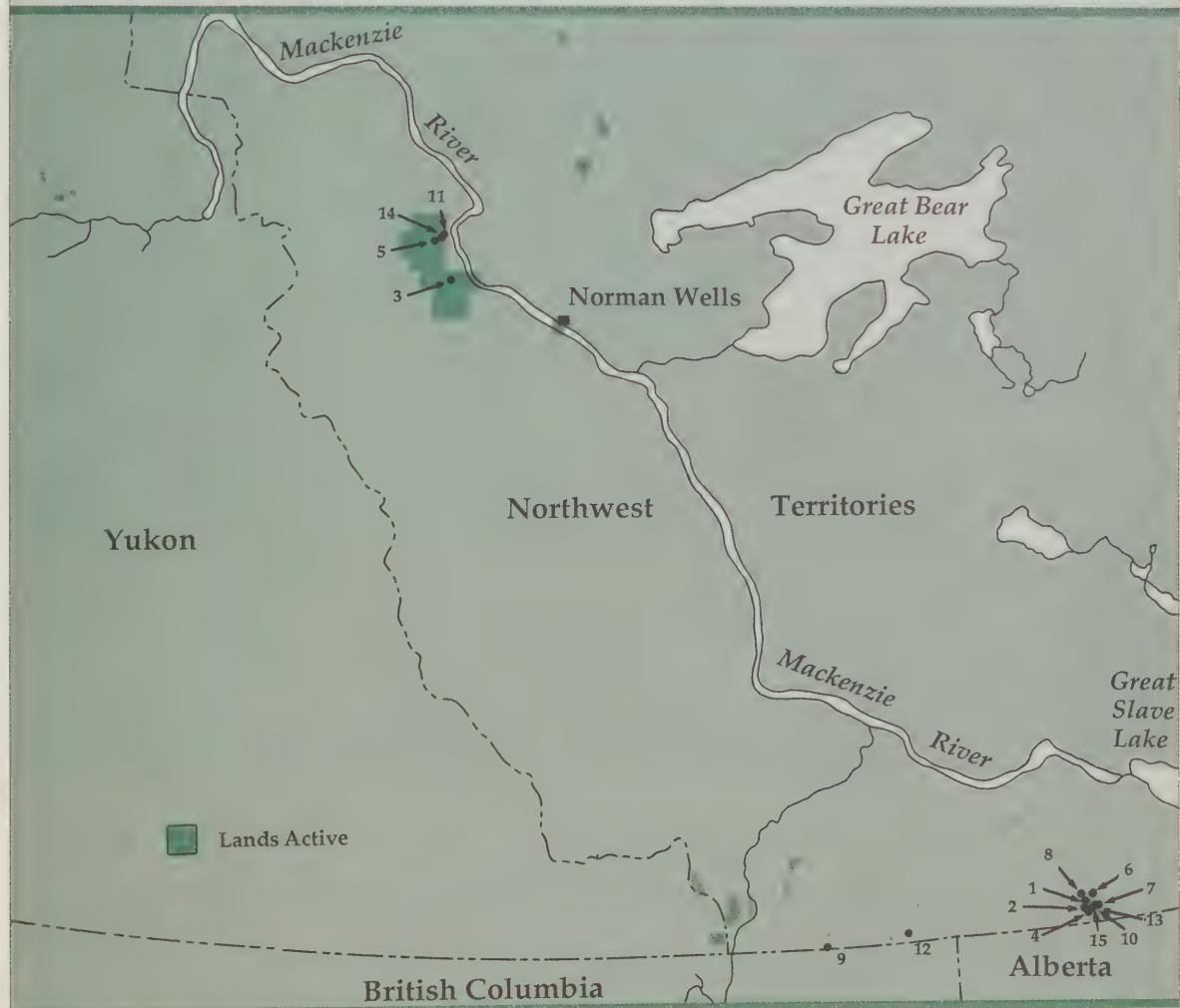
RESOURCES STATUS	1986	1987	1988	1989	1990*
Discovered Resources**					
Gas (billions of m³)	20.3	20.8	20.8	21.8	35.5
Oil (millions of m³)	51.0	37.2	37.2	37.7	37.7
Gas and Oil Production					
Pointed Mountain Gas (millions of m³)	205	156	154	96*	74
Norman Wells Gas (millions of m³)	188	163	138	129	126
Norman Wells Oil (thousands of m³)	1 411	1 531	1 728	1 789	1 841

* Includes new discoveries and revisions to previous estimates.

** As reported in previous years.

BENEFITS STATUS	1986	1987	1988	1989	1990
Rigs Active	11	3	3	5	6
Rig-Months	33	13	6	5	10
Money Spent (millions of \$)					
Geophysical/Geological	11.1	2.4	8.7	12.6	2.8
Exploratory/Delineation Drilling	54.1	4.4	6.3	11.5	26.3
Development Drilling	14.3	27.0	5.3	—	—
Production Facilities	5.6	30.5	5.3	—	—
Total Money Spent (millions of \$)	85.1	64.3	25.6	24.1	29.1

LAND STATUS	1986	1987	1988	1989	1990
Licences (ELs/SDLs/PLs)					
Concluded	0	24	18	0	1
Total ELs/SDLs Active	30	29	30	25	45
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	0	4.5	0.08	0	0
Lands Relinquished/Surrendered (millions of ha)	3.3	4.7	0.9	0.38	0.4
Lands Active (millions of ha)	5.7	2.3	1.2	0.9	0.6



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Paramount et al. Cameron C-50	60°09'04"N 117°38'41"W	Cactus 21 <i>Flint Rig 771</i>	86-03-09 86-03-26 90-02-08 90-02-15	Plugged & suspended	1 569
2.	Paramount et al. Cameron L-47	60°06'32"N 117°39'19"W	Sierra 2 <i>Roll 'n Rig 31</i> *	89-02-11 89-03-06 89-03-12 89-04-02 90-02-07 90-03-25	Plugged & suspended, oil discovery	1 565
3.	Chevron et al. Mountain River O-18	65°37'58"N 129°02'29"W	<i>Shehtah 1</i>	89-11-30 90-01-08	Plugged & abandoned	1 120
4.	Paramount et al. Cameron L-44	60°03'32"N 117°39'03"W	Sierra 2 <i>Flint Rig 771</i>	89-12-29 90-01-20 90-02-23 90-03-08	Plugged & suspended	1 634
5.	Chevron et al. Hume River I-66	65°55'34"N 129°41'39"W	<i>Shehtah 1</i> <i>Shehtah 4</i>	90-01-17 90-02-09 90-02-24 90-03-01	Plugged & abandoned	745
6.	PCI Swede E-02	60°11'26"N 117°31'25"W	<i>Hi-Tower 2</i>	90-01-19 90-02-17	Plugged & abandoned	1 527
7.	Paramount et al. Cameron A-68	60°07'06"N 117°26'17"W	Sierra 2 <i>Flint Rig 706</i>	90-01-21 90-02-12 90-03-14 90-03-25	Plugged & suspended, gas discovery	1 575
8.	Paramount et al. Swede A-73	60°12'10"N 117°43'27"W	Sierra 5 <i>Flint Rig 771</i> *	90-01-31 90-02-25 90-03-09 90-03-18 90-03-18 90-03-25	Plugged & suspended, gas discovery	1 585
9.	Shell Celibeta B-12	60°01'13"N 122°17'43"W	Peter Bawden 20	90-02-01 90-03-24	Plugged & abandoned	1 659

Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
10.	Paramount et al. Cameron J-37	60°06'36"N 117°36'26"W	Sierra 2 <i>Flint Rig 771</i>	90-02-13 90-03-10 90-03-19	Plugged & 90-03-27 suspended, gas discovery	1 576
11.	Chevron East Hume River N-10	65°59'58"N 129°15'59"W	Shehtah 1	90-02-16 90-03-04	Plugged & abandoned	445
12.	PCI Island Lake N-45	60°04'56"N 120°53'34"W	Nabors 7	90-02-21 90-03-14	Plugged & abandoned	1 450
13.	Paramount et al. Cameron N-28	60°07'59"N 117°35'08"W	Sierra 5 <i>Flint Rig 706</i>	90-02-26 90-03-19 90-03-26 90-03-28	Plugged & suspended, gas discovery	1 592
14.	Chevron East Hume River I-20	65°59'28"N 129°17'17"W	Shehtah 1	90-03-12 90-03-24	Plugged & abandoned	365
15.	Paramount et al. Cameron B-25	60°04'05"N 117°34'41"W	Sierra 2	90-03-20 90-03-23	Plugged & suspended	394

* Tested through separator.

In 1990, abandonment operations were completed for the following wells:

Pan Am et al. A-1 Kotaneelee YT P-50
 Sun Netla C-07
 Home Silt Lake H-64

Workover operations were conducted at the following sites:

Columbia et al. Kotaneelee YT B-38
 Columbia et al. Kotaneelee YT I-48
 Columbia et al. Kotaneelee YT M-17



Mackenzie Delta and Beaufort Sea

Statistical Summary

ACTIVITY STATUS	1986	1987	1988	1989	1990
Wells Spudded Exploratory/Delineation	17	3	3	5	1
Wells Terminated* Exploratory/Delineation	24	3	4	4	2
Metres Drilled Exploratory/Delineation	48 016	8 344	13 438	11 273	1 614
Geophysical Programs Run Reflection Seismic km	5	1	7	10	6
	4 756	139	11 475**	19 483**	4 371

* In the Beaufort Sea, where operations are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

** Includes three-dimensional seismic equivalent.

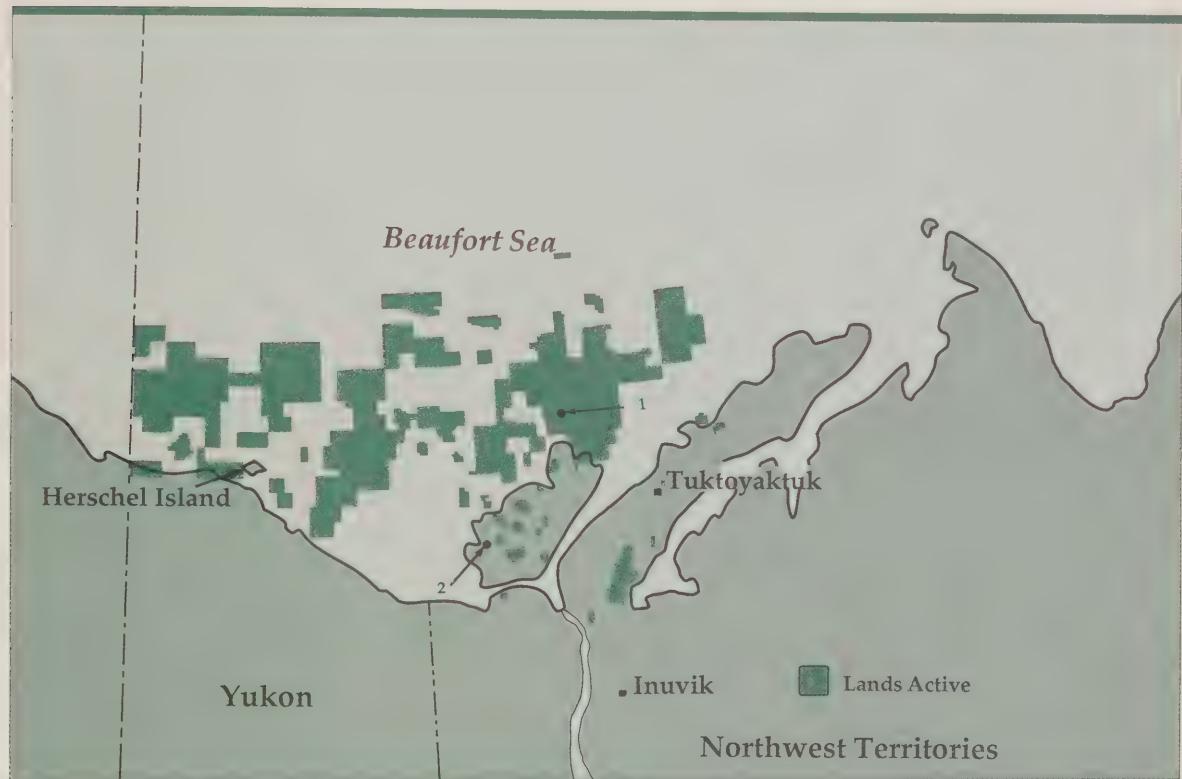
RESOURCES STATUS	1986	1987	1988	1989	1990*
Discovered Resources**					
Gas (billions of m ³)	292.8	302.1	308.5	322.7	356.6
Oil (millions of m ³)	193.2	253.2	253.2	256.4	240.7
Oil Production Amauligak (thousands of m ³)	50.4				

* Includes new discoveries and revisions to previous estimates.

** As reported in previous years.

BENEFITS STATUS	1986	1987	1988	1989	1990
Rigs Active	11	3	2	4	2
Rig-Months	43	5	10	9	2
Money Spent (millions of \$)					
Geophysical/Geological	14.6	0.2	27.6	36.6	16.6
Exploratory/Delineation Drilling	391.5	108.6	99	196.6	18.9
Total Money Spent (millions of \$)	406.1	108.8	126.6	233.2	35.5

LAND STATUS	1986	1987	1988	1989	1990
Licences (ELs/SDLs/PLs) Concluded	0	11	49	7	3
Total ELs/SDLs/PLs Active	23	28	59	62	64
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	0	2.1	1.4	0.2	0.1
Lands Relinquished/Surrendered (millions of ha)	3.1	1.4	2.1	1.4	0.7
Lands Active (millions of ha)	4.2	2.9	3.4	2.5	1.9



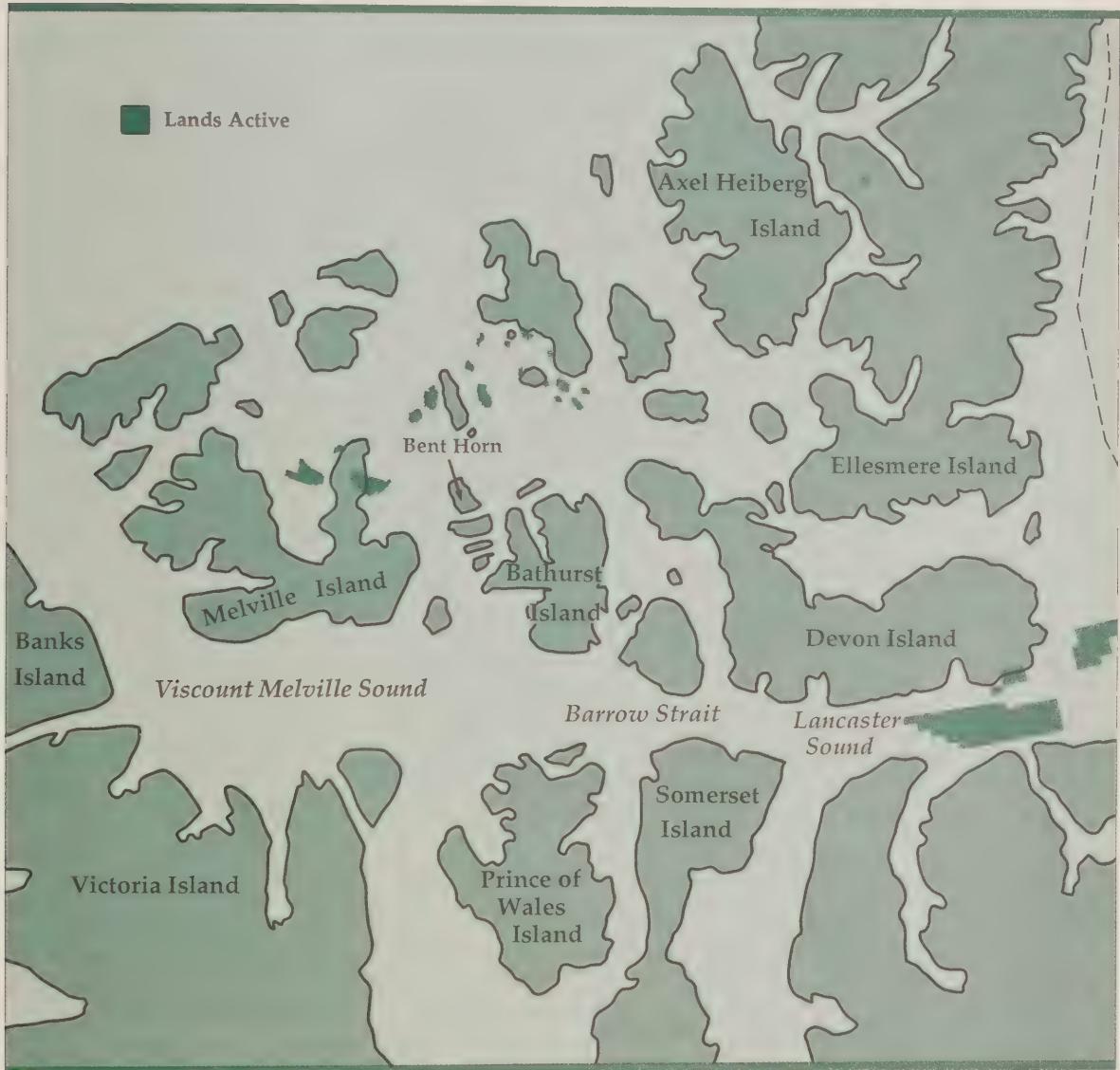
Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Esso Chevron et al. Isserk I-15	69°54'44"N 134°17'57"W	Molikpaq	89-11-11 90-01-08	Plugged & abandoned, oil & gas discovery	2 693
2.	Shell Unipkat N-12	69°11'55"N 135°19'08"W	Atco/Equatak 76	90-02-06 90-04-04	Plugged & suspended, oil & gas discovery	1 614

Arctic Islands and Eastern Arctic Offshore

Statistical Summary



ACTIVITY STATUS	1986	1987	1988	1989	1990
Wells Spudded Exploratory/Delineation	2	1	0	0	0
Wells Terminated Exploratory/Delineation	2	1	0	0	0
Metres Drilled Exploratory/Delineation	4 940	689	0	0	0
Geophysical Programs Run Reflection Seismic km	0	0	0	0	0
RESOURCES STATUS	1986	1987	1988	1989	1990
Discovered Resources*					
Gas (billions of m³)	416.4	416.4	416.4	416.4	416.4
Oil (millions of m³)	65.7	65.7	65.7	65.7	65.7
Oil Production Bent Horn (thousands of m³)	17.5	34.5	54.9	43.4	24.0
* As reported in previous years.					
BENEFITS STATUS	1986	1987	1988	1989	1990
Rigs Active	2	1	0	0	0
Rig-Months	4	2	0	0	0
Money Spent (millions of \$)					
Geophysical/Geological	0	0	0	0	0
Exploratory/Delineation Drilling	34.5	8.3	0	0	0
Production Facilities	0.6	0.5	0	0	0
Total Money Spent (millions of \$)	35.1	8.8	0	0	0
LAND STATUS	1986	1987	1988	1989	1990
Licences (ELs/SDLs/PLs) Concluded	1	3	24	0	0
Total ELs/SDLs/PLs Active	21	16	30	24	23
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	0.9	0.3	0.4	0	0
Lands Relinquished/Surrendered (millions of ha)	8.9	5.9	0.6	0.17	0
Lands Active (millions of ha)	7.5	1.6	1.4	1.29	1.29



Appendix I

Nova Scotia Offshore

(including the Gulf of St. Lawrence)

1990 data verified by the Canada-Nova Scotia Offshore Petroleum Board.

Statistical Summary



ACTIVITY STATUS	1986	1987	1988	1989	1990
Wells Spudded Exploratory/Delineation	6	3	1	0	0
Wells Terminated Exploratory/Delineation	8	3	1	0	0
Metres Drilled Exploratory/Delineation	29 744	9 583	5 208	0	0
Geophysical Programs Run Reflection Seismic km	2	1	2	1	4
	613	195	0	504	2 731*

* Includes three-dimensional seismic equivalent.

RESOURCES STATUS	1986	1987	1988	1989	1990*
Discovered Resources**					
Gas (billions of m ³)	150.6	160.9	162.4	164.7	164.7
Condensate and Oil (millions of m ³)	22.1	22.9	22.9	23.7	23.7
Oil Production (thousands of m ³) Panuke		3.7			

* Includes new discoveries and revisions to previous estimates.

** As reported in previous years.

BENEFITS STATUS	1986	1987	1988	1989	1990
Rigs Active	5	2	1	0	0
Rig-Months	22	5	4	0	0
Money Spent (millions of \$)					
Geophysical/Geological	0.9	0.2	0.2	0.7	4.5*
Exploratory/Delineation Drilling	176.8	35.3	31.5	0	0
Total Money Spent (millions of \$)	177.7	35.5	31.7	0.7	4.5

* In 1990, pre-production expenditures for the Cohasset-Panuke development project was \$18.5 million.

LAND STATUS	1986	1987	1988	1989	1990
Licences (ELs/SDLs/PLs)					
Concluded	13	3	1	13	31
Total ELs/SDLs/PLs Active	15	17	15	17	36
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	1.7	0.3	0.04	0.1	0.13
Lands Relinquished/Surrendered (millions of ha)	3.2	1.1	0.4	0.12	0.13
Lands Active (millions of ha)	1.1	0.7	0.3	0.24	0.24



Appendix II

Newfoundland Offshore

1986-1990 data verified by the Canada-Newfoundland Offshore Petroleum Board.
Statistical Summary



ACTIVITY STATUS	1986	1987	1988	1989	1990
Wells Spudded Exploratory/Delineation	7	5	7	1	1
Wells Terminated Exploratory/Delineation	8	5	8	2	1
Metres Drilled Exploratory/Delineation	31 415	17 486	19 967	5 876	3 092
Geophysical Programs Run Reflection Seismic km	1 3 537	0 0	9 3 364	0 0	7 16 401*

* Includes three-dimensional seismic equivalent.

RESOURCES STATUS*	1986	1987	1988	1989	1990**
Discovered Resources***					
Gas (billions of m ³)	146.8	146.8	146.8	148.7	162.5
Oil and Condensate (millions of m ³)	176.5	181.0	212.0	235.2	287.4

* These figures have been generated by COGLA and may differ from those published by CNOPB.
** Includes new discoveries and revisions to previous estimates.
*** As reported in previous years.

BENEFITS STATUS	1986	1987	1988	1989	1990
Rigs Active	6	2	2	1	1
Rig-Months	31	16	17	4	4
Money Spent (millions of \$)					
Geophysical/Geological	4.1	0	5.2	0	10.4*
Exploratory/Delineation Drilling	347.0	200	154.6	29.4	25.7
Total Money Spent (millions of \$)	351.1	200	159.8	29.4	36.1

* In 1990, pre-production expenditures for the Hibernia development project totaled \$58.8 million.

LAND STATUS	1986	1987	1988	1989	1990
Licences (ELs/SDLs/PLs)					
Concluded	9	1	12	5	35
Total ELs/SDLs/PLs Active	27	21	19	21	53
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	1.5	0.1	0.1	0.26	0.12
Lands Relinquished/Surrendered (millions of ha)	9.2	1.8	1.0	0.3	0.19
Lands Active (millions of ha)	3.4	1.7	0.8	0.76	0.57



Glossary

Abandoned Well: Any well that has been permanently plugged.

Annular Control Tool: A device designed to shut off the well flow before it reaches the surface.

Annulus: The space between the drill pipe and a casing string or between the drill pipe and the open hole.

Benefits Plan: A plan submitted by operators and approved by the minister that states the employment and procurement intentions of operators related to their exploration and development activities on frontier lands.

Biostratigraphy: The science of correlating rock units based on the fossil assemblages they contain.

Blowout: The uncontrolled flow of gas, oil, water or other fluid from a well.

Call for Bids: A notice published in *The Canada Gazette* or other publication, whereby the minister calls for the submission of bids in relation to Crown reserve lands.

Call for Nominations: A notice inviting interested parties to nominate tracts of lands for potential inclusion in a call for bids.

Completed Well: A well that has been drilled and equipped so that it is capable of producing oil or gas.

Cubic Metre of Gas: Equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.

Cubic Metre of Oil: Equivalent to 6,289 American stock tank barrels.

Development Plan: A plan that describes the approach and facilities that the proponent intends to use to recover hydrocarbon resources based on the proponent's interpretation of geology and reservoir characteristics of a field.

Dry Evacuation: Evacuation without requiring personnel to enter the water, e.g., evacuation by helicopter.

Exploration Licence: A licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a production licence subject to compliance with the other provisions of the *Canada Petroleum Resources Act*.

Exploration Well: A well drilled on a geological feature where no significant discovery has previously been made (synonymous with wildcat well).

Gas Hydrate: A crystalline substance composed of water and methane that exists at low temperatures.

Geotechnics: The field of science that deals with the physical and mechanical properties of soil and rock for engineering purposes.

Gravity Survey: A type of geophysical program that measures variations in the gravitational field of the earth and relates them to the densities of various rock types. This enables the form and thickness of a sedimentary basin to be determined.

Hectare (ha): 10 000 square metres (equivalent to 2.47 acres).

Hydrocarbon: A naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.

Hydrodynamic: Of or relating to the force or pressure of water or other fluids.

Ice Scour: Seabed features such as trenches, gouges and tracks, which result from the contact of moving ice masses with the seabed.

Injection Well (Injector): A well in which fluids are injected into an underground formation to increase reservoir pressure.

Landfast Ice: Sea ice that forms and remains attached to the shore.

Magnetometer Survey: A geophysical technique that measures intensity of the earth's magnetic field over an area. Variations in this intensity are related to mineralization or differing rock types both on the surface and in the subsurface.

Mobile Arctic Caisson: An annular steel caisson (better known as the *Molikpaq*), with deck dimensions of 75 m x 73 m, which is designed to be set down on an underwater berm.

Mobile Offshore Drilling Unit (MODU): Any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.

Overwintering: To pass the winter.

Petrophysical: Dealing with the relationship of rock types and parameters such as porosity to measurements obtained from down-hole wireline logs.

Polar Lows: Intense atmospheric storms that develop deep within cold air masses streaming over warm water surfaces. Relatively small in scale (i.e., less than 500 km), they develop rapidly and often generate gale force winds, which at times may reach storm force or higher.

Pressure Ridge Keels: Portions of consolidated or unconsolidated ice rubble formations extending downward below an ice pressure ridge.

Reflection Seismic: The primary geophysical technique used in petroleum exploration for mapping subsurface geological features. Acoustic pulses created at the surface are reflected from layers that have different acoustic properties within the earth. The pulses are recorded at the surface for processing and interpretation.

Rights Issuance: The process of granting industry rights to Crown reserve lands subject to the *Canada Petroleum Resources Act*.

Shallow Gas: Gas encountered in the early stage of drilling a well, before the installation of surface blowout prevention equipment.

Significant Discovery: A discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and suggests the existence of an accumulation that has potential for sustained production.

Slugging: A nonhomogenous flow of gas and liquids.

Spud: To start the drilling of a well.

Suspended Well: A well in which drilling or production operations have temporarily ceased.

Terminated Well: A well that has reached total depth and has been abandoned, completed or suspended.

Waterflood: A method of recovery in which water is injected into a reservoir to remove additional quantities of oil from the reservoir.

Work Expenditure: Actual cost of exploration activities.

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